SPATIAL PLANNING RESPONSES TO CLIMATE CHANGE

EVALUATING AND COMPARING
THE PLANNING CAPACITY TO
MAINSTREAM CLIMATE CHANGE
ADAPTATION INTO SPATIAL PLANNING IN

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Spatial planning responses to climate change

Evaluating and comparing the planning capacity of the spatial planning sector to mainstream climate change adaptation into spatial planning in

Gothenburg, Poznan and Utrecht

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Abstract

This research addresses the planning capacities that contribute the mainstreaming of climate adaptation into spatial planning. Due to the novel nature of the concept of mainstreaming, it remains poorly understood how the concept is operationalised in practice. The theoretical debate on this lacks a standardised and integral framework that assesses all relevant conditions that jointly determine the planning capacity to mainstream climate adaptation into spatial planning. The central research question therefore is: *Which planning capacities contribute to mainstreaming of climate change adaptation into spatial planning?* To answer this question, the research was divided into two phases. Firstly, an extensive literature review was conducted to develop an evaluation framework of planning capacities. Five sub-capacities were found: legal, institutional, social, resource and learning capacity. Each of the sub-conditions was given more content by identifying conditions and criteria. All concepts in the framework are treated as sensitising concepts, that is the content changed in accordance to empirical data. For the second phase in this research three projects in European cities were evaluated and compared. Analysis was based upon a content analysis of key policy and strategy documents and 31 interviews with practitioners of the planning sector, i.e. urban actors that are involved in spatial planning, such as municipal officials, property developers, governmental authorities, civil society, etc. Mutually they determine the level of mainstreaming climate adaptation into spatial planning. Regarding the five capacities the following results were found: legal capacity appeared to be important as it can set out a consistent line for climate adaptation, but it is not yet well established in the case studies. Institutional capacity is hampered by complex governance structure. Approaches towards social capacity varied greatly, but results suggest that especially the condition 'stakeholder engagement' is important. Resource capacity appeared to be well developed within the projects, however, on a wider city-scale and the long-term there is potential for growth. The findings show that learning capacity in a planning process might require more time and resources from the planning sector, but will be beneficial for mainstreaming of climate adaptation on the long-term. The overall conclusion is that no single sub-capacity nor condition is decisive. Moreover, there is no prescribed set of conditions to planning capacities which will certainly lead to successful mainstreaming of climate adaptation. Rather, the framework provides a comprehensible synthesis of relevant sub-capacities and conditions which can independently and mutually be studied to effectuate climate adaptation in spatial planning.

Key words: planning capacities, mainstreaming of climate change adaptation, spatial planning

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Contents

Chapter 1 Introduction

Academic consensus on anthropogenic climate change is well established. Climate change is a reality and observed impacts are a frontrunner of things to come (Adger, Arnell & Tompkins, 2004; Rockström et al., 2011). Environmental issues originating from climate change include sea level rise, more extreme storm events, stronger urban heat waves and longer dry periods (Hamin & Gurran, 2009; Runhaar et al., 2012). With the current climate change impacts and foresights that it will not come to a hold if current practices are continued (IPCC, 2013; Rogelj et al.,2016), society should not solely focus on climate change mitigation efforts but should also make society more capable of coping with climate change impacts through adaptation measures (Hamin & Gurran, 2009; Rockström et al., 2011; C40cities, 2015). A widely accepted definition of climate change adaptation is provided by the IPCC (2007, p.869): "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities." Adaptation measures are being taken since the costs of adapting to climate change impacts on the short-term are assumed to be lower than the damage costs that will arise due to climate change impacts (Runhaar et al., 2012).

This research addresses the urban governance of climate change adaptation. Municipalities have a major responsibility in adaptation to a changing climate as they control spatial adaptation responses. As they are increasingly understanding the importance to act, municipalities search for the best approach to engage with climate adaptation action (Measham et al., 2011; Uittenbroek, 2016; Aroas et al., 2016). A promising approach for municipalities is to mainstream climate change adaptation into spatial planning. Chapter 1 of this research will start off by discussing mainstreaming of climate change adaptation (section 1.1), followed by an explanation of climate change adaptation governance approaches in cities (section 1.2). Once these concepts and their evolution have been explained, the knowledge gaps which this research aims to address will become clear (section 1.3). In section 1.4 the research perspective is described, consisting of three sub-sections: research aim, question and scope; research framework; scientific and societal relevance.

1.1 Mainstreaming of climate change adaptation

Climate change adaptation has initially been put forward as a new individual policy domain, referred to as a dedicated approach (Klein et al., 1997; Klein et al., 2007; Jordan & Lenschow, 2013). In such cases, the focus is purely on addressing the adverse effects of climate change and creating climate proof areas (Jordan & Lenschow, 2013). It furthermore signifies own climate adaptation resources, responsibilities and formal mandate (Moser & Ekstrom, 2010; Jordan & Lenschow, 2013, Uittenbroek, 2014). More recently, however, the concept of 'mainstreaming climate change adaptation' has gained more scientific and social attention. This concept refers to the policy integration of climate change adaptation objectives into existing policy domains (Huq et al., 2004; Lebel et al., 2011; Uittenbroek, Janssen-Jansen & Runhaar, 2013; Rauken, Mydske & Winsvold, 2015) and in organisational routines (Uittenbroek, 2016). It is often argued that for climate change adaptation to be successful, it should not to be related to climate change alone but put in a wider perspective of societal issues (Smit & Wandel, 2006; Klein et al., 2007; Uittenbroek, Janssen-Jansen & Runhaar, 2013). Adaptations occur in a broader context of demographic, economic and cultural changes and are affected by technological innovations, shifts in global governance and flows of capital (Adger, Arnell & Tompkins, 2004; Jordan & Lenschow, 2013). Cooperation between different sectors on climate change adaptation is therefore desirable and can be ensured through integrating it into existing policy domains (Rauken, Mydske & Winsvold, 2015; Lebel et al., 2011).

The concepts of mainstreaming stems from a body of literature on Environmental Policy Integration (EPI) (Runhaar, Driessen & Soer, 2009; Lafferty & Hovden, 2010; Jordan & Lenschow, 2010; Weber & Driessen, 2010; Runhaar, Driessen & Uittenbroek, 2014; Uittenbroek, 2014). Mainstreaming and EPI are essentially the same concept, as both are concerned with the integration of novel environmental policy objectives into existing policy domains. Where the two concepts differ, is the fact that EPI applies to a wide variety of environmental concerns and mainstreaming solely climate change (Uittenbroek, 2014). Therefore, mainstreaming is often regarded as a form of EPI (Runhaar, Driessen & Uittenbroek, 2014). Lafferty & Hovden (2003) define two distinctive dimensions of EPI. First, the integration principle of EPI should specify what integration of environmental objectives implies for policy-making. To their understanding this encompasses that "environmental objectives need to be part of the fundamental premises of policy-making at all stages" (p.9). Second, EPI stands upon the assumption that environmental and non-environmental objectives should be balanced out. However, in the past this assumption did not always hold. Therefore, Lafferty & Hovden (2003) propose to approach EPI as avoiding environmental degradation to becoming subsidiary and should advance towards a principal or overarching societal objective in time. Along these lines, Runhaar, Driessen & Uittenbroek (2014) propose to take competing values into consideration when developing urban planning tools. This makes such tools best adjusted to the socio-political context. To assess 'integrated' environmental policy one should take into account the comprehensiveness, aggregation and consistency (Weber & Driessen, 2010).

It has been empirically shown that mainstreaming of climate adaptation increases the effectiveness and efficiency of adaptation policy-making (Uittenbroek, Janssen-Jansen & Runhaar, 2013). By combining objectives, having access to more human and financial resources and ensuring long-term sustainable investments, the effectiveness and efficiency substantially increase. Moreover, mainstreaming climate adaptation into existing policy domains provides an opening for municipalities that lack investment capacity or have an overfull political agenda (Uittenbroek, 2016). The concept of mainstreaming itself has to become mainstream, that is accepted and implemented by the majority of stakeholders, over time. An approach needs to be put in place to ''structurally and deliberately integrate climate adaptation into urban policy'' and should not merely be understood as conveniently linking climate adaptation to other policy objectives (Uittenbroek, 2014, p171).

There are several ways proposed by scholars to approach mainstreaming of climate change adaptation and in practice there are multiple variations to the interpretation. For example, the city of Madrid has an integrated strategy dating from 2008, where the energy transition (climate change mitigation) was linked to prevention of climate change impacts (City of Madrid, 2008). The city of Manchester has an action plan that sketches their desired future (2009), of which climate change adaptation is just one aspect (Carter, 2011). On the contrary, the city of Boston has published the Boston Climate Ready (December 2016) report which exclusively aims at identifying local climate change impacts and adapt accordingly (City of Boston, 2016). In the middle of these approaches there is a city like Rotterdam, which has a climate change strategy outlining the local climate change impacts and focus areas. This strategy aims to be implemented through the integration of the strategy into existing working processes at the implementation level. For this end, they have identified possible projects which allow integration of climate change adaptation and provide a set of instruments (Rotterdam Climate Initiative, 2013). Through formulating climate change adaptation as a policy objective, cities strive for a desired outcome. That is, they want to positively affect the state of the environment by integrating climate change adaptation into urban policy (Jordan & Lenschow, 2010). The coming section will elaborate on the urban governance of climate change adaptation.

1.2 Governance of climate change adaptation in cities

Climate change adaptation is a fundamental concern for every administrative level, varying from local initiatives to a global scale (Wilson, 2006; Measham et al., 2011; Aroas et al., 2016). Nonetheless, after years where climate change adaptation was regarded as a national government's task, recently, attention has been shifted to municipalities because they account for 80% of the global greenhouse gas emissions, and by 2020 80% of the European population will live in urban areas. This makes cities the responsible and legitimate entity to address climate change (Wilson, 2006; Measham et al., 2011; Carter, 2011; C40cities, 2015). Therefore, in response to this new responsibility cities are increasingly integrating adaptation measures in their spatial planning processes (Wilson, 2006; Mees & Driessen, 2011; Wheeler & Beatley, 2014; Aroas et al., 2016).

Traditional adaptation measures have long dominated the adaptation agenda of cities. For instance; expanding sewage capacity to cope with rainfall, building dikes against rising sea levels and river flooding, and planting trees for a cooler urban climate are examples of tradition adaptation measures (Mees & Driessen, 2011). Focus has shifted recently to more integral climate change adaptation solutions that have a more holistic view that besides climate protection also adds socio-cultural value to an area. As an example, practitioners favour green/blue structures as they deliver wider sustainability benefits (biodiversity conservation, climate change mitigation, recreation), which ''often seems to be a more significant trigger for action than the climate change adaptation agenda itself'' (Kazmierczak & Carter, 2010, p. 140). Achieving such sustainability benefits makes blue-green structures 'no-regret options', which can increase the support of a wider variety of stakeholders for climate change adaptation in cities (Kazmierczak & Carter, 2010; Mees & Driessen, 2011). However, climate change adaptation requires space which is usually already under development pressure, making land a scarce resource. Consequently, spatial planning has become more vital as society has become more urbanised. It concerns the "design and organisation of urban space to guide and ensure the orderly development of cities" (Ogato et al., 2017, p. 75). Competing demands for land use can be mediated through spatial planning (Mees & Driessen, 2011). Kumar & Geneletti (2015) expand the argument by stating that spatial plans bring together social, economic and physical development goals, which mutually become determinant for climate change responses in space. Through spatial planning, climate change adaptation can be given a place in urban areas. It is increasingly recognised that through spatial planning urban areas can be adapted to climate change impacts (Wilson, 2006; Mees & Driessen, 2011; Kumar & Geneletti, 2015; Aroas et al., 2016). Taken together, spatial planning is a deliberate and useful approach for the governance of climate change adaptation.

Climate change adaptation governance through spatial planning however is not easily demarcated in terms of relevant and influential actors. Bulkeley (2010) showed that climate change adaptation governance is a complex process which requires a reconfiguration of political authority between public and private actors. Mees, Driessen & Runhaar (2012) build upon this argument and conclude that efficiency and legitimacy of climate adaptation action will increase when all societal actors are involved. The authors also add that organising cooperation between actors remains challenging due to vagueness of roles and responsibilities. Wilson (2006) found that climate change adaptation planning in the United Kingdom, at that time, was executed by the local authority in isolation from other relevant actors. She ascribes the isolation as one of the factors for maladaptation. Mees & Driessen (2011) argue that public-private networks of actors have a bigger capacity to climate-adaptation issues. Also in relation to mainstreaming climate change adaptation Uittenbroek (2014) advocates for municipalities and other urban actors to change organisational routines in favour of mainstreaming climate change adaptation in policy and organisational routines.

Albeit spatial planning and urban actors have an important role on the success climate change adaptation governance in cities, many planning sectors lack the planning capacity to realise climate adaption measures. Capacity building is often applied in In the field of environmental governance and climate change adaptation as a theoretical lens to describe a system's ability to enable change (Smit & Pilifosova, 2001; IPCC, 2007 Smit et al., 2010; Mees & Driessen, 2011; Koop et al., 2017). Generally hypothesised in capacity building literature is that the higher the capacity is, the more successful environmental governance or climate change adaptation is (Mees & Driessen, 2011; Koop et al., 2017). Relating to climate adaptation, capacity building is a applied to identify and assess a set of conditions that contribute to the mainstreaming of climate change adaptation into spatial planning. Knowing these conditions is of importance as it delivers insights in contributing factors to the success of climate adaptation and practitioners can act accordingly to increase the planning capacity (Gupta et al., 2010; Koop et al., 2017). Planning capacities will theoretically be defined and related to mainstreaming of climate change adaptation in chapter 2.

Uittenbroek (2016) argues that formulating climate change adaptation policy is not too difficult, it is rather the phase towards implementation where most planning sectors lack the capacity to go forwards. A useful delineation of this phase is based upon Ekstrom & Moser's (2010) notion of the policy cycle with respect to climate change adaptation. Ekstrom & Moser (2010) have broken it down into three rational phases of climate change adaptation, including understanding the problem, planning adaptation actions and managing of implementation and upkeep of the selected options (see figure 1.1). Relating planning capacities to the stages of climate change adaptation, enhancing planning capacities of spatial planning and urban actors may stimulate further advancement towards implementation.

In conclusion, spatial planning at a city level appears to be the appropriate level to achieve mainstreaming climate change adaptation. Municipalities must however not act in isolation but rather with other actors that are relevant for spatial planning. Urban actors collectively determine the capacity to complete the climate change adaptation cycle. Doing so, climate change adaptation measures fill get mainstreamed into spatial planning.

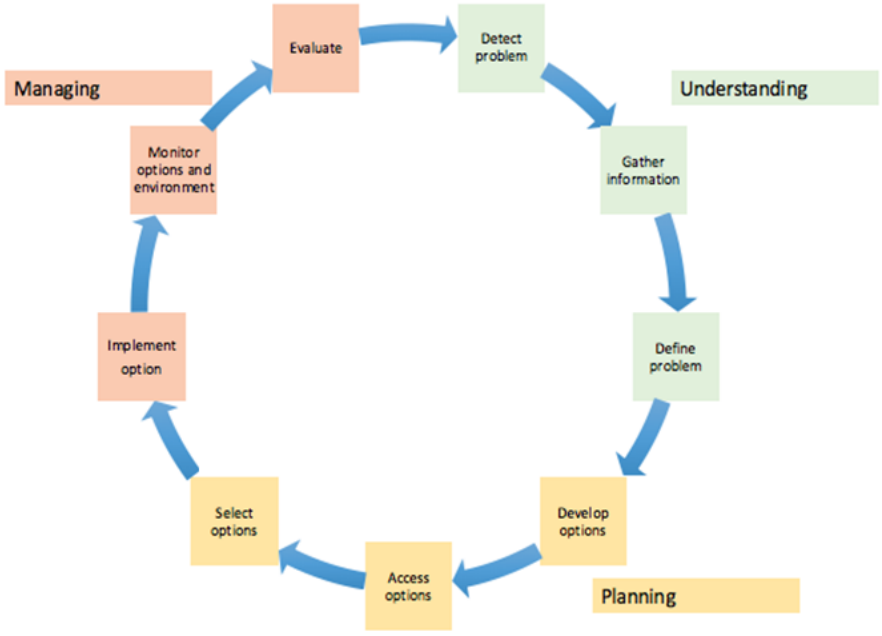


Figure 1.1. Ideal-type stages of climate change adaptation
Source: Ekstrom & Moser, 2010

1.3 Knowledge gaps

The concept of mainstreaming climate change adaptation is new and there is little understanding how this can be accomplished (Lebel et al., 2012; Uittenbroek, Janssen-Jansen & Runhaar, 2013; Rauken, Mydske & Winsvold, 2015; Ayers et al., 2014). It is clear that mainstreaming climate change adaptation cannot be addressed with a one-size- fits-all approach due to demographic, climatic and geographic differences (Bulkeley, 2010; Rauken, Mydske & Winsvold, 2015). Adger, Arnell & Tompkins (2005) have demonstrated that due to a wide variety of pathways towards suitable climate adaptation, cities experience this as a major challenge. Earlier studies have only focussed on barriers (Uittenbroek, 2016; Ekstrom & Moser, 2014) or limited geographical areas (Juhola, 2010; Uittenbroek, Janssen-Jansen & Runhaar, 2013; Lebel et al., 2012), but leaving planning capacities in relation to mainstreaming climate change adaptation understudied. Ayers (2014) recommends further research into the conditions that give risk to effective mainstreaming, this is so important because ''mainstreaming is not mainstream yet'' (Uittenbroek, 2014, p.171). This research aims at connecting these previous independent planning capacities to mainstream climate change adaptation into one framework. This framework will then address the current absence of a standardised approach to research capacities to mainstream climate adaptation into spatial planning.

Moreover, the planning capacities will be analysed integrally. Analysing planning capacities to mainstream climate change adaptation into spatial planning integrally contributes to a better understanding of a spatial planning sector's success to accomplishing climate change adaptation in practice, because the balance of all influential factors is determinant for planning capacity (Koop et al., 2017). Hypothesised that the higher the planning capacity is, the more successful mainstreaming of climate change adaptation will be. Some researchers have attempted to bring together capacities in a comprehensive framework. For instance, Koop et al. (2017, p. 3439) developed a framework of governance capacities for water challenges in cities, aimed to integrate ''the plethora of contradicting, overlapping, and fragmented governance gaps, barriers and capacities with respect to prevailing urban water challenges''. For their understanding the water governance capacity framework has to bridge connections and relations in an overarching view, which other approaches thus far were incapable to provide. Besides a holistic framework, Gupta et al. (2010), who have developed an integral framework for adaptive capacity, underline the importance to view the contextual varieties mutually as some might be of more importance in practice, depending on the context. This has not been executed for planning capacities to mainstream climate change adaptation into spatial planning. This research aims at filling this theoretical knowledge gaps.

1.4 Research perspective

The following section sets out the research perspective by firstly discussing the research aim, questions and scope. Secondly, the research framework designed to answer the research question is presented. Thirdly, the scientific and societal relevance of answering the research question will be explained.

1.4.1 Research aim, question and scope

This research aims to contribute theoretical and empirical insights to the planning capacity of the spatial planning sector to mainstream climate change adaption in spatial planning. To this end, the following research question has been formulated:

WHICH PLANNING CAPACITIES CONTRIBUTE TO MAINSTREAMING OF CLIMATE CHANGE ADAPTATION INTO SPATIAL PLANNING?

The main research question is divided into four sub-questions:

1. Which planning capacities with relevance to mainstreaming climate change adaptation can theoretically be derived from literature on governing capacities, adaptive capacities, policy development, policy integration, mainstreaming and adaptation governance?
2. To what extent are these planning capacities present in the spatial planning sector in Gothenburg, Poznan and Utrecht?
3. What are the main similarities and differences in the planning capacities to mainstream climate change adaptation among the cases and what lessons can be derived from this about the relative importance of certain planning capacities?
4. What lessons can be derived from the comparative analysis in terms of actionability to improve and enhance the planning capacity to mainstream climate change adaptation into spatial planning, and what policy recommendations can be formulated accordingly?

This research takes into account the spatial planning sector, i.e. urban actors that are involved in spatial planning, such as municipal officials, property developers, researchers, governmental authorities and consultants. This is relevant for this research as they combined determine the level of mainstreaming climate change adaptation into spatial planning. The scope of stakeholders will be specified by choosing a project in each case. In doing so, project targets, goals, design principles, adaptation solutions can be related to stakeholders who deliberately planned this. Within the project, all types of climate change adaptation solutions will be taken into account. No prioritisation is made beforehand for specific climate change impacts such as heat stress, water safety, cloudburst or droughts. It is recognised that the nature of climate change impacts can influence adaptation responses and will be taken into consideration in the evaluation framework. Füssel (2007a) distinguished two types of adaptation, it either being 'autonomous' or 'planned' adaptation. The latter concerns adaptation measures undertaken by private actors like installing air-conditioning. The former, on the contrary, refers to adaptation solutions that are purposefully planned as adopting new building codes. Within this research the focus will lay on 'planned' adaptation measures. New urban projects provide a valuable case to mainstream climate change adaptation into spatial planning as it provides an encouraging framework or context to incorporate adaptations for urban actors (Carter, 2011). As discussed previously, especially the planning phase of the adaptation cycle is interesting to study as most issues arise in this phase. This does imply that the adaptation cycle has not fully been completed. Consequently, the adaptation outcome cannot be evaluated, but rather the process towards it. Policy development, spatial planning choices and adaption intentions known at the time of research will be incorporated. The current planning capacity will thus be evaluated with the aim to potentially improve the planning capacity where possible.

1.4.2 Research framework

This section provides an overview of the research steps and shows the research framework as depicted in figure 1.2. First of all, an extensive literature review was conducted to develop an evaluation framework for planning capacities to mainstream climate change adaptation into spatial planning (Chapter 2). The methodology for the empirical data gathering is further elaborated in Chapter 3. Following, chapters 4 to 6 provide the case descriptions. In chapter 7 the cases are compared by applying the evaluation framework. Chapter 8 answers the research question and critically discusses the set-up of the research. For this step some validation interviews were held to test results on accuracy and relevance. This is further explained in chapter 3. Furthermore, recommendations for practitioners are given and areas for future research are identified.

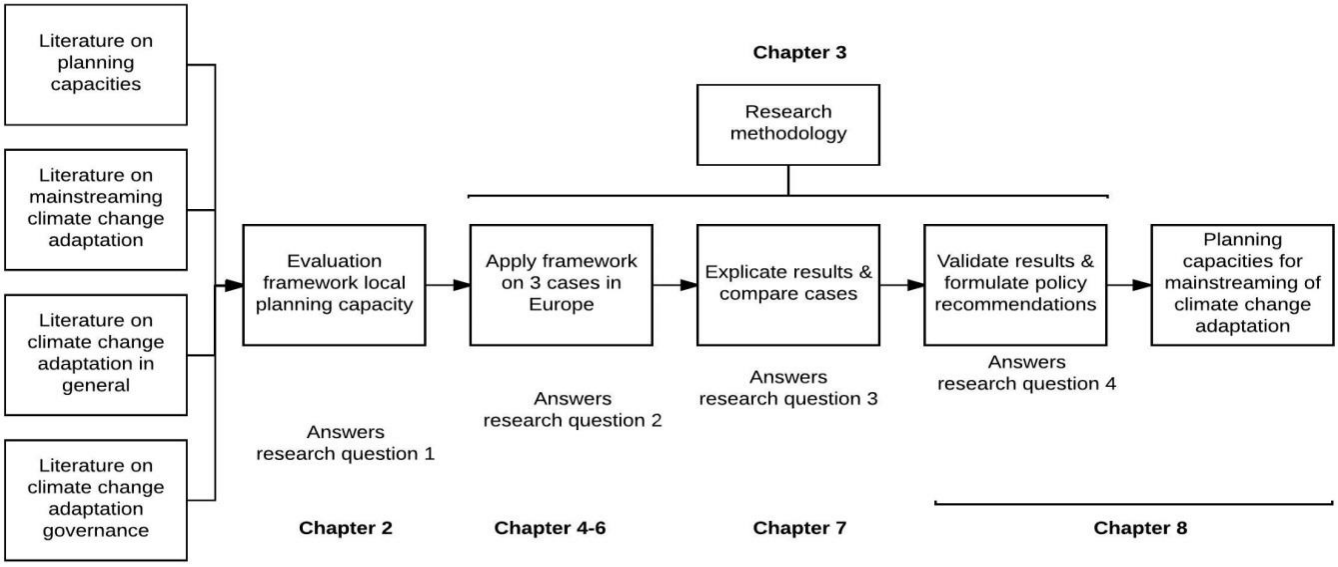


Figure 1.2. Structure of the research

1.4.3 Scientific and societal relevance

The societal and practical relevance of answering the research question are further explained in the following section. Due to the novel nature of the concept of mainstreaming, it remains poorly understood how the concept is operationalised in practice. Although mainstreaming climate change adaptation has no single 'best' approach, nor a linear process (Ayers, 2014), the framework developed here will provide valuable insights in the required planning capacities for effective mainstreaming of climate change adaptation. Moreover, this research has an integral set-up, aimed to systematically develop an approach that includes all influential factors for the process of mainstreaming climate change adaptation. In this research much attention will be paid to the planning capacities mutually.

With respect to the societal relevance, evaluating the planning capacities to mainstreaming climate change adaptation will provide valuable insights to improve the planning capacities and overcome the issues the planning sectors under investigation face. With this knowledge, practitioners in the planning sector can hopefully proceed in the climate change adaptation cycle from planning to the implementation phase (Moser & Ekstrom, 2010; Uittenbroek, 2016). Doing so, climate change impacts on society will be limited. The societal relevance is further enhanced and directly applied due to the involvement of the engineering and consultancy firm Sweco. Knowledge from this research can be applied in practice by them to fulfil their goal: 'Designing cities of the future'. Climate adaptation has recently been acknowledged as an independent business unit. They have shown great interest in the outcome of this research as they observe a significant increase in demand on climate change adaptation inquiries and issues in their working field. This accounts for all the of the countries where they operate, which is why European cities where Sweco is located were chosen; Gothenburg, Utrecht and Poznan. They therefore supported with defining the research aim, choosing relevant cases (see section 3.2) and relevant connections within the cases. With the outcome of the research they may get a better understanding on the influential factors to successful mainstreaming of climate change adaptation into spatial planning.

Chapter 2 Planning capacity in theory

This chapter conceptualises the planning capacities to mainstream climate change adaptation into spatial planning. This conceptualisation will be used to assess the performance of mainstreaming climate adaptation in the three cases. It is assumed that local planning capacity is a precondition for successful governance of urban climate change adaptation. After all, spatial configurations determine a city's level of adaptation to climate change. Section 2.1 first defines planning capacity. Section 2.2 discusses how the evaluation framework was developed by reviewing relevant governance and climate adaptation governance literature. This results in a list of concrete planning capacities that are subsequently operationalised in section 2.3.

2.1 Defining planning capacity

In the field of environmental governance and climate change adaptation there is a vast body of literature on capacity building (Smit & Pilifosova, 2001; IPCC, 2007 Smit et al., 2010; Mees & Driessen, 2011; Koop et al., 2017). As mentioned before, it is generally hypothesised in capacity building literature that the higher the capacity is, the more successful environmental governance or climate change adaptation is (Mees & Driessen, 2011; Koop et al., 2017). The following section debates related concepts where the definition stems from.

There is no common understanding of the concept capacity building. Multiple theoretical definitions exist and it is applied in several working fields. An often applied approach is that of Governance Capacity, which focuses on the capacity for good governance by an organisation, institution or any other object of analysis (Smit et al., 2010). Koop et al. (2017, p.3430) have defined governance capacities as: "the key set of governance conditions that should be developed to enable change that will be effective in finding dynamic solutions for governance challenges of water, waste, and climate change in cities". They applied the governance capacity approach to understand local issues and processes, which can be used to develop recommendations and set up learning processes for water challenges and climate adaptation issues. Their reference to enabling change is relevant as the mainstreaming of climate adaptation requires behavioral changes, and adjustments in routines and planning process (Uittenbroek, 2016). In relation to spatial planning, Albrechts' (2004) notion of planning capacity refers to the ability to achieve desired spatial planning outcomes, practically referring to the ability to implement the chosen strategies (Albrechts, 2004, p.749).

Specifically, in relation to climate change adaptation the adaptive capacity framework is of interest. Smit & Pilifosova (2001) define adaptive capacity as a system's overall capability to respond, cope and recover from future climatic stressors by implementing adaptation options. Gupta et al. (2010) have developed an 'adaptive capacity wheel' to assess different characteristics of institutions that enable the capacity of societies to adapt. In their definition institutions are understood as the social rules that both constrain and empower social actors. Six conditions have been deduced to address institutions on their adaptive capacity: 'variety', 'learning capacity', 'room for autonomous change', 'leadership', 'resources' and 'fair governance'. Grothmann et al. (2013) have added the condition 'willingness and perceived ability to adapt' as a psychological factor to complement the conditions that describe purely a 'objective context'. Also several organisations have adopted the capacity building approach for their work. For example, The Intergovernmental Panel on Climate Change (IPCC) defines adaptive capacity as "the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" (IPCC, 2007, p.21).

Generally it is agreed upon that results of capacities are highly context-dependent (Adger, Arnell & Tompkins, 2005), but the planning capacities can be applied in different contexts. Moreover, the planning capacity represents a balanced set of conditions that need to be present, no single governance condition is decisive (Gupta et al., 2010; Koop et al., 2017). This will be taken into account in this research by developing an evaluation framework that encompasses all possible governance conditions and analyzing these governance conditions mutually.

Based on the descriptions of similar concepts, planning capacity has been defined as:

A set of planning conditions that enable change that will be effective in finding dynamic solutions to achieve a desired planning outcome, which in the light of this research is the mainstreaming of climate change adaptation into spatial planning.

2.2 Developing an evaluation framework

This following section discusses how the evaluation framework for planning capacities was developed methodologically and the main body of literature that was consulted.

2.2.1 Research strategy to develop an evaluation framework

In order to develop an evaluation framework for this research, desk research consisting of an extensive literature review, was conducted. For this purpose, scientific literature from the disciplines climate change adaptation, planning capacities, mainstreaming climate change adaptation climate adaptation governance was consulted. The most used database was Google Scholar, but often complemented with articles found on Scopus. Additionally, some aspects were complemented with grey literature; policy reports, research reports and advisory reports. Search terms as 'capacities to (mainstreaming) climate adaptation', 'conditions/elements contributing to climate adaptation' and 'influential factors to climate adaptation' were used to synthesise literature into a framework. Additionally, during the process two interviews were conducted with a researcher who has carried out a PhD project on the topic mainstreaming climate change adaptation in the period 2010-2014[1]. This was set up as expert interviews aimed to get a general overview of key themes and to discuss the evaluation framework. The first interview was at the start of the research project to get a general overview of key themes and refine the evaluation framework. In addition, a second expert interview was arranged to discuss mainstreaming of climate change adaptation in the Netherlands.

The concepts in the evaluation framework are treated as sensitising concepts. There was aimed to be consciousness on what the concepts mean, where they come from and how they affect the research questions. Consequently, the conditions and criteria as derived from literature are not definitive concepts. Rather, based on fieldwork and consciously reading climate adaptation governance related literature, some concepts changed in content, different interpretations were given, were added or removed. Refining concepts based upon experiences from fieldwork ensures that the conditions and criteria accurately explain real influential factors, and that the concepts truly relate to planning capacity to mainstream climate change adaptation into spatial planning. This enhances internal validity of this research (Bryman, 2008; Verschuren & Doorewaard, 2010).

- [1] Uittenbroek, C.J. (2014). How mainstream is mainstreaming? The integration of climate adaptation into urban policy (published doctoral dissertation). Utrecht University, Utrecht, the Netherlands.

2.2.2 Evaluation framework for planning capacities

Figure 2.1 provides an overview of the five planning capacities with their critical conditions. Section 2.3 gives a more detailed description of each condition and its criteria.

Based on the governance capacity approach, Arts & Goverde (2006) highlight the importance to take into account the legal qualities of a system. Therefore, *LEGAL CAPACITY* is added to the framework. Arts & Goverde (2006) have developed a normative framework for policy evaluation based on the concept of congruence of policy arrangements. Their framework does not intend to prescribe policy making but rather as a supportive tool to understand and explain policy practices by assessing formal regulations and policy principles of spatial planning in relation to climate change adaptation. This is important as policy arrangements can stimulate adaptation and assess the environmental equity aspects of adaptation (Mees et al., 2014).

Cuevas et al. (2016) have developed a capacity classification of three challenges for mainstreaming climate change adaptation of which institutional capacity is one. *INSTITUTIONAL CAPACITY* deals with rules, social structures and organisations involved in mainstreaming climate change adaptation (Cuevas et al., 2016, p.6). The conditions that will be operationalised are organisational structure (Cuevas et al., 2016) and accountability (Bovens, Schillemans & Hart, 2008; Cuevas et al., 2016). For the purpose of this research it is complemented with embeddedness of climate change adaptation in public policy, concerning the principles, discourses and values regarding climate change impacts and adaptation. These need be aligned among practitioners and in public policy. The level of embeddedness in policy and among practitioners affects effectiveness of climate adaptation (Koop et al., 2017).

Some capacity frameworks emphasise the role of the social structures that co-exist besides the institutional setting. These social structures of climate change adaptation are classified under *SOCIAL CAPACITY* in the evaluation framework. For example, Koop et al. (2017) have developed a governing capacity framework for water challenges in cities. It has a structure based on the conditions knowing, wanting and enabling. Under wanting it assessed stakeholder engagement and under the condition enabling it considers networks relatedness. The conditions under social capacity are network participation and stakeholder engagement. In addition, numerous researchers have focused on community integration in climate change adaptation policy arrangements (Ivey et al., 2004; Alan, 2006; Aalst, Cannon & Burton, 2008; Hegger et al., 2017). The community will be included as an independent sub-capacity of the social capacity.

Next to institutional capacity, Cuevas et al. (2016) have also distinguished resource and information capacity as two capacity classifications in their framework. The *RESOURCE CAPACITY* refers to the financial and human resources that ensure mainstreaming. For the purpose of this research also technical resources are recognised as an important condition of resource capacity as technical solutions provide significant opportunities to adapt urban areas to a changing climate with more severe weather events (Wilby & Dessai, 2009; Sowers, Vengosh & Weinthal, 2011). Information capacity focusses integration of climate change information into the information system of implementing climate change adaptation. Information capacity is altered to *LEARNING CAPACITY* as continuous learning is an essential complement to information resources for practitioners in developing and sustaining capacity to be climate adaptive (Pahl-Wostl, 2009; Gupta et al., 2010). Information resources and social learning are distinguished as conditions for learning capacity.

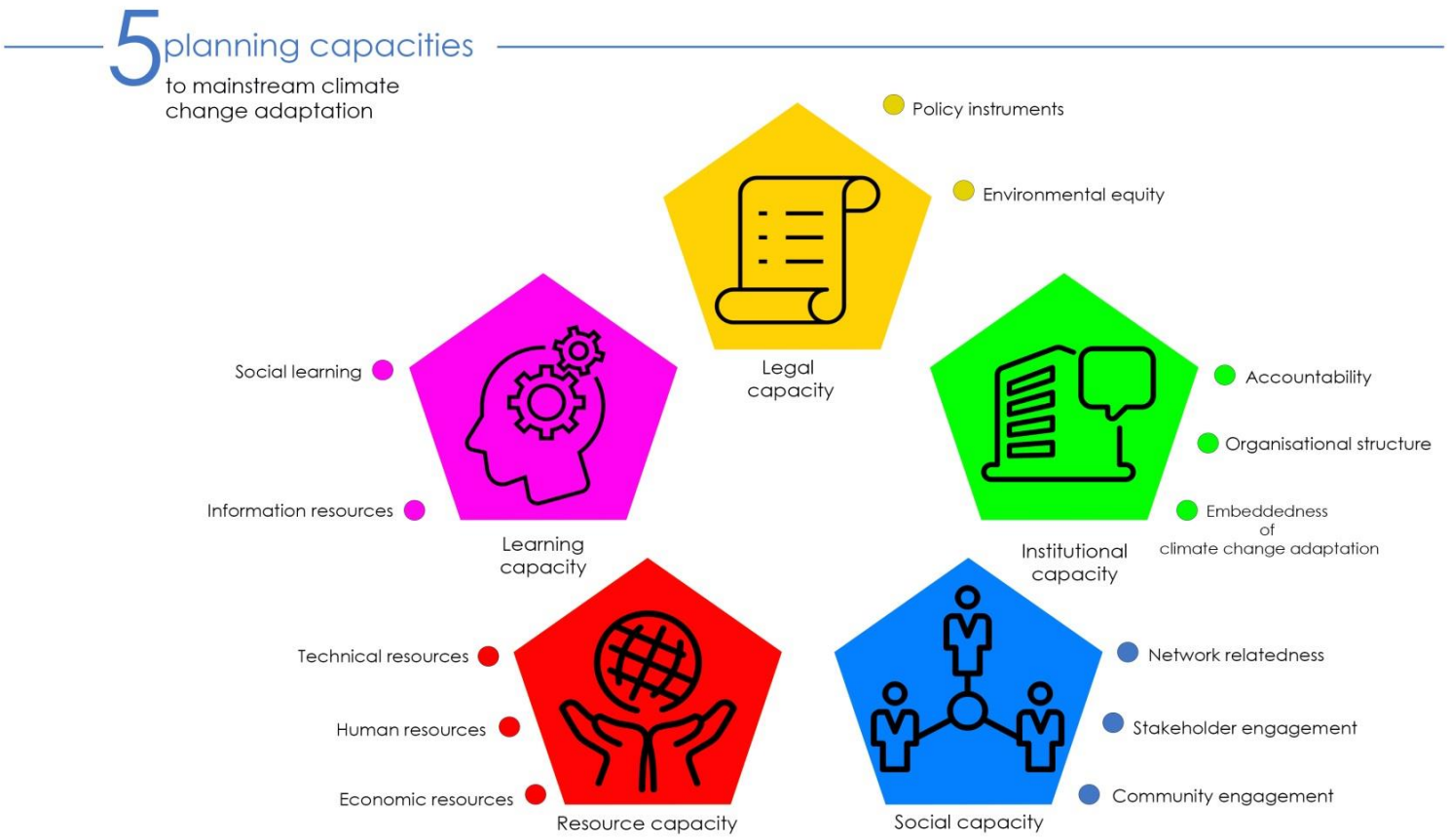


Figure 2.1. Evaluation framework for planning capacities to mainstream climate change adaptation into spatial planning
Based upon: Aarts & Goverde, 2006; Cuevas et al., 2016; Koop et al., 2017

2.3 Operationalising the evaluation framework for planning capacities

The following section sets out the theoretical background of the evaluation framework for planning capacities in relation to mainstreaming climate change adaptation into spatial planning. This is done on three levels; one of the five planning capacities, conditions to this planning capacity, and subsequent criteria under each of the conditions. Moreover, all of the criteria are operationalised into one or more indicators to measure the strength. Each section is ended with a table which summarises the components of each planning capacity. The planning capacities will be discussed in the sequential order of the evaluation framework, starting at legal capacity going clockwise.

2.3.1 Legal capacity

According to Arts & Goverde (2006) it is of importance to analyse legal qualities of a system. Legal qualities represent law and governance principles as justice and legality. Through legal arrangements, climate change adaptation in urban areas can be stimulated or counteracted, and thus affect the state of adaptability of a city. For the purpose of this research, policy instruments and environmental equity will be discussed as conditions.

Policy instruments

Mees et al. (2014, p. 58) define a policy instrument as "a deliberate structured effort by governors to solve a policy problem by modifying actions of the governed". Gupta et al. (2008) argue that regulative institutions should address both formal rules (legal structures, regulatory frameworks) and informal rules (principles and norms) in policy documents. Policy instruments that are in place can partly explain effective implementation of climate change adaptation strategies. It is often argued that in order for climate change adaptation to be successful, there need to be a set of legal and spatial policy instruments which protect existing and enhance new climate change adaptation measures (Müller & Siebenhüner, 2007; Tompkins et al., 2010). Mees et al. (2014) and Cuevas et al. (2016) regard having policy instrument as a hard prerequisite for climate change adaptation. Without them, a city cannot be adapted to climate change. Policy instruments as spatial plans are regulatory frameworks that regulate land use. Laws comprise legal control. Both instruments can be employed to secure current adaptation measures or ensure future implementation of climate change adaptation measures. The former usually is observed in protection and maintaining of existing urban functions that contribute to the city's adaptation level. For example, protection green strokes for new buildings or expanding existing water retention areas. The latter can be done through allocating land for greenery, water retention, water protection or other adaptation measures; or by stimulating multi-functional usage in terms of blue/green structures, green roofs, etc.

Mees et al. (2014) have listed multiple policy instruments (a wide variety) categorised as legal, economic and communicative which can be deployed to foster climate change adaptation. A wide array of policy instruments can be deployed within the realm of climate change adaptation, and it is advised to introduce multiple and use the policy instruments dynamically (Müller & Siebenhüner, 2007; Gupta et al., 2010; Mees et al., 2014; Lundqvist, 2016). For the purpose of this research the following three criteria for policy instruments are further elaborated upon:

1. The presence of policy instruments
2. Policy cohesion
3. Statutory compliance

PRESENCE OF POLICY INSTRUMENTS is an important influential factor for both climate mitigation and adaptation efforts. It can be deployed to outline adaptation efforts in policy documents. Moreover, policy instruments refer to tools that facilitate adaptation (Shardul & Samuel, 2008; Corfee-Morlot et al., 2009). Regarding the latter, these include, for instance, regulatory incentives as zone planning, financing schemes as subsidies for green roofs, and R&D activities as research programmes on adaptation options and its effects (Shardul & Samuel, 2008). Local action is required as the impacts are felt locally and measures are implemented on a local scale, but local authorities cannot comprehend the complexity of climate change alone. Therefore, policy instruments on all governmental levels should be taken into account (Corfee-Morlot et al., 2009; Lundqvist, 2016). The indicator therefore is (1) the existence of policies and regulations regarding climate change adaptation at a national, regional, municipal and project level.

Through *POLICY COHESION* local authorities might achieve a better balance between climate mitigation and adaptation, reduce unintended negative consequences of those actions, and better link urban development objectives with climate change actions. Climate change actions are thus not solely linked to the environment but should be an integral part of urban development strategies. Integrated planning arrangements would be able to better address climate change adaptation issues (Corfee-Morlot et al., 2009). Hajer et al. (2015) state that planners have to go beyond the traditions

cockpit-ism (top-down approach) and mobilise actors from different sectors and organisations in order to have a combination of perspectives. A combination of perspectives on sustainable development can contribute to a better understanding of the synergies and tensions inherent to alternative pathways to sustainable development (Hajer et al., 2015). Contradictions in policies can be redressed or avoided by better synergies. This makes policies more effective in going to implementation (Corfee-Morlot et al., 2009). The indicators to measure the level of policy cohesion are: (1) the level of contradictions and (2) overlap between policies and regulations on a national, regional, municipal and project level.

The *STATUTORY COMPLIANCE* will be taken into account as policy instruments are not used or misused then policies or legislation will lose credibility and, eventually, legitimacy (van Rijswick et al., 2014). The presence of a coordinating body can stimulate application of formal or informal policy instruments (Bryson, Crosby & Stone, 2006; Müller & Siebenhüner, 2007; van Rijkswick et al., 2014). It is argued that rules and agreements that are based on shared values and principles will be easier to enforce because parties have the strong conviction that they should behave in conformity with the rules (van Rijswick et al., 2014). Respect for agreements and compliance with agreements increases as the application opportunities are broadened (Bryson, Crosby & Stone, 2006; Müller & Siebenhüner, 2007).

Flexibility is needed to ensure compliance on the long-term. Current and future technological and institutional developments bring in a level of uncertainty. Policy instruments are most appropriate if they are "attentive to temporal dynamics and flexible in their responses to these dynamics'' (Müller & Siebenhüner, 2007, p. 238). Climate change adaptation is most effective if it takes into account a long-term perspective. This, in turn, is best ensured when climate change adaptation policy or measured can easily be adjusted to changes in these dynamics (Müller & Siebenhüner, 2007; Keessen & van Rijswick, 2012; Mees et al., 2014). The indicators used to measure the strength of this criterion are: (1) respect for policies, objectives and regulations among stakeholders, and (2) level of flexibility of climate adaptation policies and regulations to adjust to possible future situations.

Environmental equity

Environmental equity is a governance principle that should be considered in the field of climate change governance (Adger, Arnell & Tompkins., 2005). Due to the uneven spatial impacts of environmental change, one should be aware of its distributional consequences among social-economic groups when taking environmental decisions. Underlying power relations within institutions shape vulnerabilities of certain social-economic groups (Adger, Arnell & Tompkins., 2005). Kruize (2007, p. 16) defines environmental equity as "the distribution of environmental burdens and benefits among socio-economic groups". Social vulnerability is in environmental justice and equity literature often used to express the burdens and benefits of certain socio-economic groups to environmental decisions. Adger (1999) specified the concept of vulnerability in relation to climate adaptation to a multilevel governance perspective, concluding that institutional and economic factors affect the baseline vulnerability of different social groups. Changes in the institutional and economic settings can decrease vulnerability. Füssel (2007b) argues that besides internal social-economic factors (household income, social networks, access to information) also biophysical factors like local climate and spatial planning determine the social vulnerability (Füssel, 2007b, p. 158).

Adger, Paavola & Hug (2006, p.4) brought attention to the phenomenon that climate change adaptation measures and strategies create their own winners and losers depending on the choice of solutions of the governance of collective and individual responses to climate change. Moreover, they argue that vulnerabilities sometimes consolidate rather than reduced due to climate change adaptation measures because costs and benefits are unequally distributed (Adger, Paavola & Hug, 2006). Vulnerability varies greatly in an urban area. The built up area (density of houses, paved area) determines if an area is prone to heat stress or at high risk of flooding (Climate Proof Cities, 2014). It are generally vulnerable groups who experience disproportionately experience the negative effects of climate change (Thomas & Twyman, 2005). This makes vulnerability next to a technical issue (less paved areas, increase amount of greenery) also a social issue of equal distribution of the burden of social groups (Adger, 1999; Thomas & Twyman, 2005; Paavola & Adger, 2006). The condition environmental equity will be discussed by two criteria:

1. Social vulnerability issues related to adaptation planning
2. Redistribution mechanisms to promote environmental equity

The *SOCIAL VULNERABILITY ISSUES RELATED TO ADAPTATION PLANNING* will be analysed in the light of climate change effect and to what extent climate change adaptation measures have an effect on all social classes, including the more vulnerable ones. As Adger, Arnell & Tompkins (2005, p. 82-83) state, equity of social vulnerability can be evaluated from the perspective of outcome (who wins and losses from climate change adaptation) and who takes the decision for adaptation. This highly related to each other. Protection from the social forces that create inequitable exposure to risk will be as important if not more important than structural protection from natural hazards in reducing the vulnerability (IPCC, 2007). Policy-makers and practitioners can contribute to this (Füssel, 2007b; Ribot, 2010). Decision-makers and practitioners should therefore be aware of the affect adaptation measures can and will have on vulnerable groups in terms of social vulnerability. The indicator for this criterion is (1) the level of awareness on the relation of social vulnerability and environmental equity situations where social groups are disproportionality affected by climate change impacts

REDISTRIBUTION MECHANISMS THAT PROMOTE ENVIRONMENTAL EQUITY are promising policy option for policymakers to tackle causes of social vulnerability (Kelly & Adger, 2000). Systematically determining causes of vulnerability and mapping them to scales and appropriate institutions are two steps in a vulnerability reduction process that policymakers and practitioners should execute and employ. Accordingly, policy solutions can be drafted to resolve the inequality. In high income countries a high reduction in vulnerability to climate-related risks is observed due to policy and planning (Ribot, 2010). Kruize (2007) highlights the importance of transparency on environmental equity issues. Having pinpointed vulnerable spots to climate change in the city is one thing, communicating vulnerable spots to the public is perceived as a way to enhance environmental equity. Transparency on the data is crucial and considered as a tool not to fight environmental inequality directly, but rather to establish an equal basis for decision-making. The indicator to describe the strength of the criteria are (1) the extent of openness of data on climate change vulnerability of social groups, and (2) the inclusion of redistribution mechanisms to address social vulnerability of certain social groups.

Table 2.1. Operationalisation of legal capacity summarised

Legal capacity		
Conditions	Criteria	Indicators
Policy instruments	Presence of policy instruments	Existence of policies and regulations regarding climate change adaptation at a national, regional, municipal and project level
	Policy cohesion	Level of contradictions between policies and regulations on a national, regional, municipal and project level
		Level of overlap between policies and regulations on a national, regional, municipal and project level
	Statutory compliance	Respect for policies, objectives and regulations among stakeholders
		Level of flexibility of climate change adaptation policies and regulations to adjust to possible future situations
Environmental equity	Awareness of social vulnerability issues in adaptation planning	Level of awareness on the relation of social vulnerability and environmental equity situations where social groups are disproportionality affected by climate change impacts
	Redistribution mechanism that promote environmental equity	The extent of openness of data on climate change vulnerability of social groups
		Inclusion of redistribution mechanisms to address social vulnerability of certain social groups

2.3.2 Institutional capacity

The body of literature on how climate change adaptation and institutions interrelate is increasing. Amongst others, Adger, Arnell & Tompkins (2005) propose to critically analyse the institutional capacity of systems when addressing climate change impacts and responses. They argue that "public elements of responding to climate change are not fixed: they are shaped by institutional and regulatory features in each sector of this economy" (Adger, Arnell & Tompkins, 2005, p.82). Cuevas et al. (2016) adopted this approach in their methodology to address mainstreaming of climate change adaptation because it allows to examine the institutional setting and arrangements within a system. Intuitional capacity has been broken down into three critical conditions: organisational structure, accountability and embeddedness of climate change adaptation into public policy.

Organisational structure

The devastating effect of climate change impacts is to a large extent determined by the organisational set up. How actors within an urban context respond to a changing climate is determined by structures and processes (Bulkeley, 2010). Actors aim to structure the organisation of spatial or adaptation planning as efficiently and effectively as possible (Uittenbroek, 2016). In C40's (2014) report on climate action in megacities it is stated that coordination of operations and the public administration is of importance for effective delivery of climate change action. For this research it has been broken down into three criteria:

1. Support from the leadership
2. Organisation of spatial and adaptation planning
3. Vertical and horizontal coordination

SUPPORT OF THE LEADERSHIP receives much attention in adaptation literature because it is considered to be of importance for raising visibility, motivating others and allocating resources (van den Berg, 2009; Lee, 2010; Koop et al., 2017). For example, mitigation receives usually more attention than adaptation, a difference that Measham et al. ascribe to the fact that priority is placed on mitigation by leaders of city councils (Measham et al., 2011). Furthermore, Van den Berg (2009) concluded after her study on Dutch municipalities that the political preference of local politicians is a stronger determinant for climate change adaptation action than projected risk or weather event experience. Without commitment of the leadership, it is hard to allocate time and resources to climate change adaptation and to overcome conflict of interests. Moreover, support turns out to be of influence to overcoming interdepartmental conflict (Burch, 2010; Measham et al., 2011; Hamin, Gurran & Emlinger, 2014). As with other decisions in council spending, a business case for adaptation is needed to demonstrate efficiency and justify the council's spending and priorities in times of spending cuts and growing demands on key services (Lee, 2011). This cannot be done by one active member of the leadership, rather to effectively adapt to a changing climate it is needed to have climate change adaptation embedded and conveyed by several, if not all, members of the leadership (Burch, 2010; Measham et al., 2011; Hamin,Gurran & Emlinger, 2014).

Whereas support at the city council level is crucial to raise public awareness and incorporate climate change adaptation onto the city's political agenda (Lee, 2011), managers take more decisions that can push or limit climate change adaptation in projects (Schultz & Fazey, 2009). In order to determine the level of support of the leadership two indicators will be used: (1) the level of support in the city council and (2) among managers for adaptation planning

Climate change adaptation requires and integrated approach that touches several sectors and policy fields. The *ORGANISATION OF SPATIAL AND ADAPTATION PLANNING* should not address climate change per sector individually, but rather integrally. Moreover, interaction between stakeholders has to be maintained and steered (Baycan-Levent & Nijkamp, 2009; van den Berg, 2010; Biesbroek et al., 2013). Measham et al. (2011) highlight that sectoral work within public administration is a historical problem and climate change adaptation is a novel reason to address the challenge of cross-sectoral cooperation within public administrations. Having one department would increase success on the short term, but long-standing and consistent adaptation policy, inter-sectoral cooperation allows for a more holistic vision to a crosscutting issue (Rauken, Mydske & Winsvold, 2015). They furthermore argue when that climate change adaptation is implemented by one sector or policy field this might be beneficial when climate change adaptation is poorly embedded in an organisation. In such a case, it is beneficial to quickly show first results on invested resources. Even though sectoral organisation of climate change adaptation might be less demanding and results in quick results, more compressive cross-sector involvement will increase legitimacy for the crosscutting issue. This, in turn, will increase effectiveness of implementation (Rauken, Mydske & Winsvold, 2015). Indicators to describe the organisation of spatial and adaptation planning are (1) the level of inter-sectoral cooperation to enhance long-term adaptation planning and (2) the extent to which meetings have been stipulated for the enhancement of inter-sectoral cooperation on spatial and adaptation planning.

A reoccurring theme in adaptation planning literature is the *VERTICAL AND HORIZONTAL COORDINATION* between governmental levels and between municipalities. City governments are part of bigger (inter)national and regional governmental systems which set the context for climate change adaptation (C40, 2014). As cooperation within a municipality is covered by the previous criteria organisation of spatial and adaptation planning, here horizontal coordination is referred to as interaction between local governmental authorities. For vertical coordination, the interaction between different governmental levels will be looked. Even though climate change adaptation is often regarded as an issue for local authorities, vertical coordination is essential to take into account as many adaptation actions lie within the responsibility of bigger governmental authorities (Bauer, Feichtinger & Steurer, 2012). Especially within the European context, where every member state is obliged to have developed a climate change adaptation strategy by 2017 (EU Adaptation Strategy, 2013), there has to be alignment between the different governmental level for the national strategy to be effective at the local level (Bauer, Feichtinger & Steurer, 2012). Too often there is too little interaction between different governmental levels leaving cities unable to influence national climate change adaptation strategies, which, limits the adaptation responses on a lower level (C40, 2014).

Regarding horizontal coordination, Bauer & Streurer (2014) found that regional cooperation represent a new governance approach to climate change adaptation. It shows potential as these cooperation evolve bottom-up and have a stakeholder-centred approach. This opposed to vertical cooperation that mostly originates from a legal setting. Unique from these horizontal partnerships with regional authorities is that they address local and sectoral knowledge gaps regarding climate change impacts and adaptation actions cooperatively. This brings benefits in terms of resources and learning from each other (Bauer & Streurer, 2014). To assess coordination vertically and horizontally two indicators have been defined: (1) level of vertical coordination with other governmental levels regarding spatial and adaptation planning and (2) level of horizontal coordination with other local authorities regarding spatial and adaptation planning.

Accountability

Accountability is an essential characteristic of governance frameworks and is considered to be of importance for institutional effectiveness (Bovens, Schillemand & Hart, 2008; Biermann et al., 2010; Keohane & Victor, 2011; Biermann et al., 2012; Biermann, 2014). It concerns the question whether or not authorities should be held accountable for their actions. More specifically, accountability addresses provision of information on policy processes and an explanation of decisions made or actions taken, and, if unsatisfactory, are there authorities to hold accountable (Lebel et al., 2006). This can be as well individuals as groups. If this is achieved an institutional is more effective in its action. Three criteria are further elaborated:

1. Transparency
2. Clear division of responsibilities
3. Person/group to be held accountable

TRANSPARENCY on planning processes is acknowledged as an influential factor for establishing accountability (Gupta, 2008; Biermann & Gupta, 2011; Smith & Wiek, 2012; OECD, 2014). Smith & Wiek (2012) argue that transparency is increasing in importance due to the fact that climate change adaptation is increasingly focussing on participation of stakeholders. Western democratic societies have public participation and access to information regarding planning processes regulated by law. Openness of information is about financial managements, information on use of funds, stakeholders that are participating in the planning process and referring to legal policies (Tanner et al., 2009; Terpstra, Carvalho & Wilkinson, 2013). The indicators used to measure transparency are (1) the extent of openness and transparency of spatial planning processes, and (2) the existence of formal governmental policies or regulations to promote openness of data.

Institutional effectiveness can be achieved by providing a *CLEAR DIVISION OF ACTORS' RESPONSIBILITIES*. Biermann (2014) argues that for international organisations to be effective and efficient, overarching principles are needed to regulate tasks and interactions between stakeholders. As an example he sets forward the critical importance of clearly defined and differentiated responsibilities and concludes that this aspect remains a key challenge in international cooperation. Bovens, Schillemans & Hart (2008) argue that the effectiveness of an institution increases greatly when responsibilities have been confined clearly within an institution. Baker et al. (2012) argue similarly for occasional spatial planning groups existing of urban actors. Several other studies have empirically found that unclear responsibilities within a local arena leads to maladaptation as people either do not act as they assume somebody else will or work inefficiently (Amundsen, Berglund & Westskog, 2010; Baker et al., 2012; Uittenbroek, 2016). Uittenbroek (2016), for example, asserts that the responsibilities of each actor should be stated clearly as this provides consistent coordination. However, when studying mainstreaming of climate change adaptation, it should be reckoned that over-formulated responsibilities can become a barrier. A certain level of flexibility needs to be maintained (Uittenbroek, Janssen-Jansen & Runhaar, 2013; Uittenbroek, 2016). The indicators for this criterion are (1) the extent to which the division of responsibilities for climate adaptation are formalised and (2) the level of familiarisation to these responsibilities among stakeholders.

Increasing autonomy to local government should be paired with greater accountability. Therefore, the criterion *PERSON/GROUP TO BE HELD ACCOUNTABLE* is discussed in the light of climate change adaptation planning. Bovens, Schillemans & Hart (2008) argue, next to the institutional effectiveness

of clear division of responsibilities, that accountability also has a democratic perspective. This democratic perspective of public accountancy regards the control by citizens over elected representatives (Bovens, Schillemans & Hart, 2008). One should beware of ambiguous accountability, which negatively affect the performance. If tasks are ambiguous or complex, then accountability is clearly more problematic from a democratic perspective as unclear and ambiguous mandates leave them more room to serve their own interests (Schillemans, 2011). The indicator is (1) the presence of a person/groups held accountable for climate change adaptation.

Embeddedness of climate adaptation in public policy

The condition embeddedness of climate change adaptation in public policy is incorporated to address the questions to what extent climate change adaptation policy is interwoven in historical, cultural and the political context. Head (2010) has researched climate change adaptation from a cultural ecology perspective, seeing the level of embeddedness in public policy and among practitioners as the indicator of the deliberate and conscious nature of the climate change adaptation. If climate change adaptation is deliberately and consciously is embedded into public policy, then the resulting actions are more likely to be successful. Many scholars have researched the embeddedness of climate change adaptation in institutions with different theoretical goggles. Oppermann (2011, p.72) has researched "the way in which narratives, discourses, concepts, language and policy fundamentally shape and limit how climate change and adaptation are problematised, and what policies results''. Hajer & Versteeg (2005) define a discourse analysis of environmental politics as a tool to see how meaning is given to an environmental policy issue. From a different perspective, authors agree that the level of climate adaptation embeddedness in terms of reoccurrence of climate adaptation as discourse or in policy language is an indication of the meaning and importance that is given to climate adaptation. The better embedded in public policy, the more effective climate change adaptation action will be (Hajer & Versteeg, 2005; Head, 2010; Oppermann, 2011; Rijswick et al., 2014). For the purpose of this paper, the embeddedness refers to the representation of values, principles and discourses regarding climate adaptation in public policy, set out into two conditions:

1. Discourse embeddedness of climate change adaptation into public policy
2. Ambitious and realistic targets

Climate change adaptation in practice is effected by the *DISCOURSE EMBEDDEDNESS OF CLIMATE CHANGE ADAPTATION IN PUBLIC POLICY.* Burch (2010) states that the level of success of climate adaptation responses is determined by policy directives that articulate climate change adaptation as a municipal priority. Put differently, policy discourses determine the content of a climate change adaptation problem. As an example van Rijkwick et al. (2014) discuss two Dutch policies; in the Netherlands there are policies that focus on water safety by building dikes and at the same time there are policies that envision living with water. Discourses provide a context in which phenomena are understood and thereby contribute to the problem definitions (Hajer & Versteeg, 2005); either water being a threat requiring dikes or as a contribution to the liveability. Climate change adaptation as a discourse has to do with the level of urgency felt. Historical events such as an extreme weather event affect the problem framing of climate change adaptation (Hajer & Versteeg, 2005; Burch, 2010; van Rijswick et al., 2014). As indicators there will be looked at (1) the occurrence of climate change adaptation and adaptation planning in policy documents and lingual usage by respondents, and (2) the sense of urgency among stakeholders for climate change in terms of feeling the necessity to adapt.

An important part of climate change adaptation embeddedness in public policy are the formulated goals and targets in terms of the *AMBITIOUS AND YET REALISTIC GOALS*. Koop et al. (2017) suggest that climate change adaptation targets need to meet dominant discourses. Climate change adaptation being a relative new phenomenon for some municipalities, there are few municipalities that have clear ambitions and targets (van den Berg, 2013). In a framework for water challenges Koop et al. (2017) assess climate change adaptation targets into the ambitions reflected in the goals and to what extent the goals are realistic. This concerns if the targets are novel and exceed current standards. Setting a dot on the horizon with logical intermediate steps makes target implementation more manageable (Burch, 2010). Indicators used to assess if the targets are ambitious and realists are (1) the extent to which formulated targets address new challenges rather than conventional ones, and (2) the level of cohesion between long-term and short/mid-term targets.

Table 2.2. Operationalisation of institutional capacity summarised

Institutional capacity		
Conditions	Criteria	Indicators
Organisational structure	Support of the leadership for climate change adaptation	Level of support in the city council for adaptation planning
		Level of support among managers for adaptation planning
	Organisation of spatial and adaptation planning	Level of inter-sectoral cooperation to enhance long-term adaptation planning
		Extent to which meetings have been stipulated for the enhancement of inter-sectoral cooperation on spatial and adaptation planning
	Vertical and horizontal coordination	Level of vertical coordination with other governmental levels regarding spatial and adaptation planning
		Level of horizontal coordination with other local authorities regarding spatial and adaptation planning
Accountability	Transparency of spatial and adaptation planning	Extent of openness of data and documents regarding spatial and adaptation planning
		Existence of formal governmental policies or regulations to promote openness of data.
	Clear division of responsibilities	Extent to which responsibilities for climate change adaptation have been formalised
		Level of familiarisation to these responsibilities among stakeholders
	Person/group to be held accountable for climate change adaptation	The presence of a person/groups held accountable for climate change adaptation
Embeddedness of climate change adaptation in public policy	Discourse embeddedness in public policy	Occurrence of climate change adaptation and adaptation planning in policy documents and lingual usage by respondents
		Sense of urgency among stakeholders for climate change in terms of feeling the necessity to adapt
	Ambitious and realistic targets	Extent to which formulated targets address new challenges rather than the conventional ones.
		Level of cohesion between long-term and short/mid—term targets

2.3.3 Social capacity

Social capacity is being added to the framework as stakeholder interaction on different levels is been given considerable weight in adaptation, planning capacity and policy mainstreaming literature (Keiner & Kim, 2007; Hunt & Watkiss, 2011; Soste et al., 2015). For the purpose of this research, social capacity is defined by the processes underlying social contact of urban actors and stakeholders of the spatial planning sector and outside of it. Examining the social capacity provides a deeper understanding of 'society's preferences' (van Aalst, Cannon & Burton, 2008) and can touch upon the aspects of inclusions of relevant actors (Keiner & Kim, 2007). This will positively affect the integration of climate change adaptation into policy and practice. The social capacity will be discussed along the lines of three conditions: network relatedness, stakeholder engagement and community engagement.

Network relatedness

In 2005, Bulkeley & Betsill argued in their article 'Rethinking Sustainable Cities' that protection of urban areas is not solely confined to the traditional local, national and global environmental politics distinctions, but rather involves new network spheres of authority. More recently, Bulkeley & Betsill (2013) have validated their work and concluded the number of municipal initiatives to tackle climate change through knowledge networks has increased significantly. Municipal and non-state actors find each other in (trans)national city networks where initiatives and knowledge are being shared. Cities participate in city-to-city networks "to learn from peers or cities that are facing similar challenges and experience similar conditions'' (Keiner & Kim, 2007, p1373). City networks have proven themselves useful to fill gaps existing in the mandate of national governments in advancing climate resiliency for cities by setting new agendas and attracting own resources. Moreover, cities can sometimes extract more relevant information from transnational municipal networks because cities within a wider international context might have more in common with each other than with cities within their own regional and national context. This particularly accounts for bigger and more influential cities that do not have much in common with smaller regional counterparts (Keiner & Kim, 2007; Fünfeld, 2015). Network relatedness was assessed on the following criterion:

1. Active participation in network

Innovative cities often *ACTIVELY PARTICIPATE* in (trans)national, whose aims include best-practice transfer, learning among their members at home and abroad, and the representation of their members' interests within the national, European and international multi-level system (Kern et al., 2008; Bulkeley & Betsill, 2005; 2013). There is a wide variety of national and transnational municipal networks for cities to join, addressing different climate change themes, purely professional or with strong scientific foundation.

Participation varies greatly among cities, in as well in contributions to the network as utilisation of knowledge from a network (Keiner & Kim, 2007). According to Fünfgeld (2015) transnational city networks are becoming important catalysts for local adaptation. At present, however, much remains unknown about the catalytic and deliberative roles of transnational city networks that extend beyond basic, functional aspects of collaboration (Fünfgeld, 2015). Fünfgeld (2015) critically concludes that much more empirical research needs to be conducted to answer the question whether or not transnational city networks add significant value to local adaptation measures. This is a legitimate question to ask because the local context needs to be standardised against the international approaches. This argument has also been made by Kern & Bulkeley (2009), who stress that municipalities are keen on producing best practices for climate change adaptation,

but that does not necessarily mean that it will actually be taken up and/or enacted accordingly. Rather, it is being used as inspiration of as indicator of the merits and potential of adapting locally. Two indicators are defined to measure the strength of the criterion: are (1) the presence of relevant networks that are in place for spatial and adaptation planning, (2) extent to which stakeholders actively participate in networks on spatial and adaptation planning (3) utilisation of network participation in local spatial and adaptation planning in terms of sharing methods, best practices and knowledge.

Stakeholder engagement

Stakeholder engagement for planning climate change adaptation is widely regarded as an important factor for successful implementation of climate change adaptation measures (Hunt & Watkiss, 2011; Sherman & Ford, 2014; Soste et al., 2015). Stakeholder engagement is being put forward by Wittmayer & Loorbach (2016) as a critical principle to establish a sound basis of support when developing and executing policies. It is assumed that adaptation planning will be more supported by stakeholders if they are engaged in the decision-making or design process (Glucker et al., 2013; Wittmayer & Loorbach, 2016). Furthermore, strong stakeholder engagement will support satisfactory cooperation between different institutions (Wittmayer & Loorbach, 2016). Boschma (2005) categorises this as follows: when institutional proximity is too high, it is to be expected that transitions will be minimal because new ideas or innovations cannot emerge due to a possible locking. When institutional proximity is too low, then there is no shared understanding of cultural values and the issue at hand, which will hamper transitions (Boschma, 2005). In the light of mainstreaming climate change adaptation, stakeholder engagement is crucial to establish a shared understanding of the issue of the complex issue climate change. Two criteria will be further defined:

1. Stakeholder participation in decision-making
2. Well-balanced power relations

A crucial aspect of stakeholder engagement is *STAKEHOLDER PARTICIPATION IN DECISION-MAKING*. According to Wittmayer & Loorbach (2016) stakeholder participation in decision-making increases the sense of ownership among stakeholder on the climate change adaptation solutions. Sense of ownership triggers engagement as stakeholders agree on the guiding principles and can identify themselves with the decisions. The latter point is of importance for the mainstreaming of climate adaptation, because integrating into the routines of all relevant stakeholders will be more logical and natural when practitioners have a sense of ownership and are engaged. In the same line of reasoning, Soste et al. (2015) argue that stakeholders need to develop a feeling of significance in the adaptation planning, a sense that their cooperation matters. Sense of ownership is a natural consequence of good inclusion of stakeholders and can be triggered by providing information and participating in decision-making process (Boschma, 2005; Glucker et al., 2013; Soste et al., 2015). When only informing stakeholders without actively involving them in the decision-making, no legitimacy among stakeholders will be generated (Glucker et al., 2013). Yet, informing stakeholders is an important factor for the participation of stakeholders as it provides room to deliberate for stakeholders if informed timely. Furthermore, it provides room to get familiar with different types of knowledge and statements from other stakeholders (Müller & Siebenhüner, 2007).

Few, Brown & Tompkins (2007) nuance the application of open participatory processes. Their argument is that stakeholder participation is most optimal when defining overall targets and to stimulate climate adaptation action. However, an open participatory process in unlikely to produce a consensus strategy that incorporates long-term targets and uncertain consequences. Glucker et al.

(2013) also critically reflect on inclusive decision-making, stating that it can prolong the process which negatively affects efficiency. This generally occurs when topics show a lot of overlap, for instance, between water governance and climate change adaptation. Indicators to measure the strength of stakeholder participation in decision-making are (1) the level of open stakeholder participation in the decision-making, (2) the extent to which all stakeholders are timely informed on spatial and adaptation planning and (3) sense of ownership on spatial and adaptation choices among stakeholders

The criterion *WELL-BALANCED POWER RELATIONS* addresses the power dynamics among stakeholders in spatial and adaptation planning. Few, Brown & Tompkins (2007) point out that stakeholder engagement is generally advocated for climate change adaptation, but state that this should critically be reflected in the light of power relations. An imbalance in power dimension of stakeholders participation can, unless specifically addressed, counteract public participation (Few, Brown & Tompkins, 2007). A frequently observed pitfall is when within a planning processes containment of participation occurs. This arises when stakeholders participation is geared towards predefined goals, blocking dissent and avoiding scope for conflict (Few, Brown & Tompkins, 2007).

Bryson, Crosby & Stone (2006) stress that well-balanced power relations do not per se imply equal power, rather it is based on uneven power and mixed motives. They argue, based on a case study research, that power dynamics should refer to even access to information, resources and equal say in the decision-making process. Unequal power among collaborating partners is a source of mistrust, an acknowledge threat to the effectiveness of stakeholder participation. In order to have meaningful stakeholder participation, one should establish preparedness of agencies to place trust in stakeholders' contribution. Indicators to measure the strength of the criterion are (1) the extent of equal power relations among stakeholders in spatial and adaptation planning, (2) the sense of trust among stakeholders on other stakeholder's contribution to the planning and adaptation process, and (3) the presence of tactics for dealing with (dis)proportionate levels of power between stakeholders,

Community engagement

Arguably, communities can be regarded as stakeholders and should therefore be discussed under stakeholder engagement. However, for the purpose of this research, community engagement will be debated as an independent condition of social capacity, focussing more on the role of inhabitants and their commitment to an area. "It is people in their roles as inhabitants, fathers, mothers, or engaged neighbours who become actors in transition governance activities, rather than (only) as professionals as is the case in many transition management processes in functional systems'' (Boschma, 2005 in Wittmayer & Loorbach, 2016, p. 28). As well residents' initiatives or consent is usually necessary as their role in tailoring adaptation measures to citizens' needs (Hegger et al., 2017). A major advantage of community engagement is 'place-based' management, assuming that communities are most familiar with local characteristics and in a good position to advice with adaptation planning (Measham et al., 2011). Hegger et al. (2014) found that participatory processes between Dutch municipalities and its inhabitants on flood risks management yielded positive effects in terms of high flood risk consciousness and a proactive approach by the inhabitants at time of high water. There is evidence that a community's awareness and proactive will increase when risks are more conceivable (Hegger et al., 2017). Under community engagement two criteria will be discussed:

1. Informing the community
2. Community participation in spatial and adaptation planning

The criterion *INFORMING THE COMMUNITY* is considered to be influential for the level of community engagement in adaptation planning. Sheppard et al. (2011, p. 410) called for meaningful information in public processes "at the local level to build awareness, capacity, agency on climate change and support planning and decision-making". Measham et al. (2011) see a major role for municipalities to educate citizens in their role in climate adaptation through the provision of adequate information. The crux of information provision within the realm of climate change is the usability of the information for communities. Therefore, climate knowledge producers need to formulate conclusions in a way that it is rather easy to understand and can be customised by users for their interest (Lemos, Kirchhoff & Ramprasad, 2012). Sheppard et al. (2011. P. 402) propose three requirements. Firstly, bring the climate change information down to the local level. Secondly, use holistic scenarios which combine several climate scenarios with possible responses. Thirdly, use visual tools to maximise interest and achieve quick learning. Information methods come in many shapes and forms, but there is generally advocated for employing a set of communication tools; i.e. workshops, assessments, best practices, customers events, competitions, research programmes and internal communication (Hanger et al., 2013). Interactive web-based mechanisms or forums could potentially make face-to-face contact redundant due to the high level of customisation and value-adding (Lemos, Kirchhoff & Ramprasad, 2012). Indicators are (1) the existence of communication tools to inform the community on adaptation planning.

COMMUNITY PARTICIPATION IN SPATIAL AND ADAPTATION PLANNING is being put-forward as a major feature of climate change adaptation. The way in which the community has been given a formal role in spatial and adaptation planning, however, is widely discussed among scholars and knows many variations in practice (Adger et al., 2009; Biermann & Gupta, 2010; Amaru & Chetri, 2013; Hegger et al., 2017). According to Hegger et al. (2017), residents' commitment has three distinctive forms; residents as citizens with regard to governmental actors, focussing on actions taken by citizens around the house; residents as consumers with regard to market actors, relating to the extent to which market parties are approaching consumers to undertaking climate adaptation measures; residents as members of civil society, seeing residents' actions as community. Not all forms are fully exploited. Engaging residents more might hold a significant potential for successful implementation of climate adaptation (Hegger et al., 2017). Biermann and Gupta (2010), who address community participation from a normative perspective, stress that legitimacy, effectiveness and fairness of decision-making can be achieved through participatory governance and formal public consultations of spatial and adaptation plans.

A frequently occurring problem with community participation is the community's lack of awareness (Amaru & Chetri, 2013; Hegger et al., 2017). Adger et al. (2006) argue that up taking and implementing community-initiatives are conducive for a behavioural change as citizens then consider their behaviours in relations to the climate and its impacts on urban areas. Indicators for this criterion are (1) extent to which the community has a formal 'voice' in the spatial and adaptation planning process, and (2) the existence of formal governmental policies or regulations to promote community initiatives.

Table 2.3. Operationalisation of social capacity summarised

Social capacity		
Conditions	Criteria	Indicators
Network relatedness	Active participation	Presence of relevant networks that are in place for spatial and adaptation planning
		Extent to which stakeholders actively participate in networks on spatial and adaptation planning
		Utilisation of network participation in local spatial and adaptation planning in terms sharing methods, best practices, knowledge
Stakeholder engagement	Stakeholder participation in decision-making	Extent to which all relevant stakeholders are timely informed on spatial and adaptation planning
		Sense of ownership on the spatial and adaptation planning choices among stakeholders
	Well-balanced power relations	The extent of equal power relations among stakeholders in spatial and adaptation planning
		Sense of trust among stakeholders on other stakeholders' contribution to the planning and adaptation process
		Presence of tactics for dealing with (dis)proportionate levels of power between stakeholders
Community engagement	Informing the community	Existence of communication tools to inform the community on spatial and adaptation planning
	Community participation in decision-making	Extent to which the community has a formal 'voice' in the spatial and adaptation planning process
		Existence of formal governmental policies or regulations to promote community initiatives

2.3.4 Resource capacity

Resource capacity is a frequently mentioned theme in climate change adaptation literature. Effective institutions are associated with their ability to generate resources, which is highly affected by the local context within which institutions exists (Gupta et al., 2008; Wilby & Dessai, 2009). Three conditions are further elaborated upon in the following section: economic resources, human resources and technical resources.

Economic resources

It is widely acknowledged among scholars that the economic situation is an important determinant for the level climate change adaptation that municipalities put into practice (Smit & Pilifosova, 2001; Shardul & Samuel, 2008). This is reflected in the fact that wealthy nations can better bear the costs of climate change adaptation to impacts and risks than poorer countries. Vulnerability is in literature also explicitly linked to poverty. A phenomenon that is observed at all levels, individual, household, municipal and national level (Smit & Pilifosova, 2001). The economic resources of a planning sector will be made insightful by addressing three criteria:

1. Affordability
2. Willingness to pay
3. Financial continuation

For climate change adaptation to be successful, the proposed measures have to be *AFFORDABLE* at all levels and among all stakeholders of the planning sector. Unfortunately, this is not often the case. Raising adequate financial resources is a well-known bottleneck in adaptation planning (Shardull & Samuel, 2008; UNEP, 2016). According to the adaptation finance gap report by the UNEP (2016) the global cost for climate change adaptation will increase threefold by 2040. Shardull & Samuel (2008) argue that more attention should be paid to including private actors to gather adequate financing for adaptation planning. Accumulatively, their budget spent on adaptation to climate change far exceeds the public budget. For extracting external financing, a strategy with an accompanying budget needs to be presented to ensure that money is well spent. Adaptation often involves money and justification of spending is required to establish legitimacy (UNEP, 2016). The indicator is (1) the availability of adequate internal and external financial resources for adaptation planning.

WILLINGNESS TO PAY for practitioners is based upon the consideration they have to make; do the expected results of an adaptation measure outweigh the calculated costs? (Marshall, 2013). This is based on having up-to-date and detailed information for the beneficiaries (Sunstein, 2004; Marshall, 2013). Stakeholders' perception of climate change also appears to be an influential factor for willingness to pay. Veronesi et al. (2014, p. 2) found that "climate change perception has a significant and positive effect on the willingness to pay to reduce these risks''. Furthermore, C40 advises to highlight as much benefits as possible of climate action, including some that are not directly translated into monetary values. In one of C40's advisory publication 'Benefits of climate action' (2016), they have identified the wide variety of benefits of climate change adaptation. By doing so, they aim to increase the willingness to pay for municipalities because by knowing the spectrum of possible benefits they can make a better case for climate change adaptation (C40, 2016). The indicators to assess the willingness to pay are (1) the extent to which stakeholders are willing to pay for adaptation measures in terms of cost benefit consideration and perception of local climate

change impacts, and (2) the extent to which co-benefits of adaptation have been identified to enhance willingness to pay.

As benefits of climate adaptation can be yielded on the long-term, adaptation is most efficient when calculated on a long time scale (Adger, Arnell & Tompkins, 2005). The criterion *FINANCIAL CONTINUATION* refers to whether or not continuous financial support for climate change adaptation on a long time span is assured. This entails as well allocation of financial resources for planned future investments, such as maintenance work, as unforeseen situations (Shardull & Samuel, 2008). This is, however, challenging as current finance flows for adaptation planning are not fully understood (UNEP, 2016). Shardull & Samuel (2008) state that financing adaptation by itself is not enough. It has to be complemented with proper policies that ensure proper spending of the money. Policies have to be drafted that actives private investments, but also regulate public spending on adaptation planning (UNEP, 2016). Moreover, policies contribute to long-term planning of climate adaptation (Shardull & Samuel, 2008). Indicators to measure financial continuation are (1) presence of financial resources that secure long-term adaptation planning, and (2) the existence of formal policies to attract financing and to ensure that money is well spent.

Human resources

Human resources is widely recognised as a crucial condition for governance capacity, adaptive capacity and planning capacity. Applicability in a framework, however, differs greatly among scholars. Grothmann et al. (2013) have extended Gupta et al.'s (2010) a framework by adding psychological-social factors that affect a planning sector's adaptive capacity, namely actors' 'motivation' to adapt to climate change and 'belief' in the effectiveness and realisation of adaptation measures. Multiple studies address human resources mostly from a knowledge and expertise perspective. This is clear from the following definitions: ''availability of expertise, knowledge and human labour" (Grothmann et al., 2013, p3374); "knowledge and labour or the ability to command labour" (DFID, 1999, p.19); "overall education levels and the skill and knowledge of stakeholders" (Bergquist et al., 2012, p.4). Being operationalised they generally share features as high education and level of skills enables effective adaptation planning. Some studies do mentioned motivations and intrinsic willingness to act, but as a highly interlinked feature of expertise under human capital. Grothmann et al. (2013, p.3374) define human capital as knowledge resources with a typology from about knowledge about underlying informal values, norms and beliefs of different actors (Grothmann, et al., 2013). In the DFID report from 1999 it is stated that human capital in terms of expertise is fuelled by 'intrinsic values' for climate adaptation. These notions of human capital taken together are confined to three criteria:

1. Social acceptance
2. Expertise
3. Human manpower

The criterion *SOCIAL ACCEPTANCE* concerns two distinctive features for adaptive capacity as proposed by Grothmann et al. (2013), which are motivation and belief. 'Adaptation motivation' refers to actors' motivation to realise, support and/or promote adaptation to climate change. 'Adaptation belief' relates to actors' perceptions on the realiseability and effectiveness of adaptation measures. These factors were recognised by Grothmann et al. (2013) to be of influence on the adaptive capacity of institutions. Brien and Wolf (2010) also argue that subjective dimensions of climate change should not be discarded, because this is what matters to most people, including decision-makers. The

perception of climate change adaptation highly determines the adaptation goals and ambitions, and actions that are being taken accordingly. According to the Brien & Wolf (2010), motivation to act to climate change begins with awareness of climate change globally and, maybe more importantly, locally. The underlying assumption is that "vulnerability is not only simply about the negative material outcomes associated with climate change, but also about how these outcomes are differentially valued, and how they influence the lives and well-being of both humans and other species" (Bien & Wolf, 2010, p.233). The indicators to measure social acceptance are (1) the level of motivation of stakeholders to realise, support and/or promote adaptation planning, and (2) the level of belief of stakeholders on the realiseability and effectiveness of adaptation measures.

Skills and know-how of practitioners are conceptualised under the criterion *EXPERTISE*. Gupta et al. (2010) have defined human resources as the availability of expertise, knowledge and human labour. Expertise and knowledge for climate adaptation is confined to specific localities and is consequently difficult to extrapolate to another context. Preston, Westaway, & Yuen (2011) have proposed two typologies for local expertise and knowledge: having acknowledged local skills and knowledge of individuals responsible for adaptation planning and having fully assessed these. Additionally, the inclusion of market parties can substantially expand the base of local knowledge and bring in relevant expertise which is not present within local authorities (Mees, 2014). The indicators are (1) presence of requires skill set for adaptation planning and (2) the ability to include external experts/knowledge.

The criterion *HUMAN MANPOWER* addresses human capital quantitatively. Quantity has to do with the sheer number of people involved in adaptation planning. Or in other words, it deals with the sufficiency of staff, dedicated to adaptation planning, as well as the part-time involvement of staff through project teams, committees, partnerships and other forms of collaborative organisation (DFID, 1999; Grothmann et al., 2013). The indicator is (1) presence of sufficient human manpower with adaptation planning.

Technical resources

A final condition of the resource capacity of a planning sector are the technical resources. These provide significant opportunities to adapt urban areas to a changing climate with more severe weather events (Wilby & Dessai, 2009; Bruin et al., 2009; Sowers, Vengosh & Weinthal, 2011). Many cities tend to emphasise large-scale technical solutions as storm-flood barriers or inundation fields (Sowers, Vengosh & Weinthal, 2011). At this day human societies can utilise numerous 'high' technologies as accurate weather forecast systems. Technologies can be employed for both 'hard' adaptation measures, such as water retention areas, and 'soft' adaptation measures, such as advanced weather forecast systems (UNFCCC, 2006). Two criteria of technical resources are further elaborated upon:

1. Variety of solutions
2. Technical feasibility

Gupta et al. (2010) have added *VARIETY OF SOLUTIONS* to their adaptive capacity framework because climate change is an unstructured and complex problem which cannot be dealt with by a single solution. There is no optimal solution that provides optimum safety to climate change impacts, rather a set of mutually consistent solutions are needed. Focusing on one or too little solutions leads to path dependency which leaves no room for easy adjustments to unknown future climate change

challenges or unexpected situations. In that case there is a lock-in to a specific adaptation solution (Nooteboom, 2006). Nooteboom (2006) adds that every proposed solutions will experience as well support as resistance. Openness towards different solutions and incorporating them in the planning process will increase the likelihood of adaptation planning to be successful. Indicators to measures the criterion are (1) the existence of a variety of adaptation solutions in planning processes and (2) the extent to which formal governmental policies and informal social patterns recognise the need and foster a variety of solutions.

Even though technologies have great potential to strengthen adaptation efforts in urban areas, *TECHNICAL COMPLEXITY* can pose difficulties and challenges around climate change adaptation. Bruin et al. (2009) underline that these difficulties and challenges are impeded by technological uncertainties. It becomes more complex when adaptation solutions are designed for a long life span. If the adaptation measure has a lifespan of multiple decades, then it needs to be tested against several climate, societal and financial scenarios, which increases the level of uncertainty (Wilby & Dessai, 2009; Sowers, Vengosh & Weinthal, 2011). Compared to climate mitigation solutions, which are generally easily applicable in different geographical contexts, climate adaptation solution face more local technical challenges (UNFCCC, 2006). Therefore, climate change adaptation solutions are often tailor-made and small-scale solutions. To measure the strength of the criterion the following indicators will be used: (1) the perceived level of technical complexity in terms of uncertainties among practitioners regarding adaptation planning.

Table 2.4. Operationalisation of resource capacity summarised

Resource capacity		
Conditions	Criteria	Indicators
Economic resources	Affordability	Availability of adequate internal and external financial resources for adaptation planning
	Willingness to pay	Extent to which stakeholders are willing to pay for adaptation measures in terms of the cost-benefit consideration and perception of local climate change impacts
		Extent to which co-benefits of adaptation have been identified to enhance willingness to pay
	Financial continuation	Presence of financial resources that secure long-term adaptation planning
		Existence of formal policies to attract financing and to ensure that money is well spent
Human resources	Social acceptance	Level of motivation of stakeholders to realise, support and/or promote adaptation planning
		Level of belief of stakeholders on the realisability and effectiveness of adaptation measures
	Expertise	Presence of required skill set for adaptation planning
		Ability to include external experts/knowledge
	Human manpower	The presence of sufficient human manpower with adaptation planning
Technical resources	Variety of solutions	Existence of a variety of adaptation solutions in planning processes
		Extent to which formal governmental policies and informal social patterns recognise the need and foster a variety of solutions.
	Technical complexity	Perceived level of technical complexity in terms of uncertainties among practitioners regarding adaptation planning

2.3.5 Learning capacity

Stakeholder learning is an essential factor for practitioners in developing and sustaining capacity to be climate change adaptive (Pahl-Wostl, 2009). Gupta et al. (2010) have added learning capacity as one of the six conditions of adaptive capacity as it "allows for changed understanding based on experiences" and "permits stakeholders to question socially embedded ideologies, frames, assumptions, claims, roles and procedures that dominate problem solving" (Gupta et al., 2010, p. 463). This is beneficial when dealing with climate change because stakeholders need to have an open attitude to changing conditions regarding climate change. Moreover, Hanger et al. (2013) state that respondents in their study on knowledge and information needs of adaptation policy-makers indicated that they want adequate forms of learning rather than solely provision of information. Given the recurring importance of social learning as a precondition for climate change adaptation, learning capacities have been added to the evaluation framework. Information resources and social learning are two conditions which are operationalised.

Information resources

Information resources are regarded as crucial for adequate planning within any policy field, used as input in the policy development or execution phase (Renn, 2008; Amudsen, Berglund & Westskogh, 2010). Specifically for climate adaptation, climate change-related information is required to developed proper and effective adaptation measures that reduce impacts of climate change on an urban environment. Information that is present should be used actively and there has novel information must be generated (Füssel, 2007b; Renn, 2008; Pahl-Wostl, 2000; Amudsen, Berglund & Westskogh, 2010). Three criteria of information resources will be elaborated upon:

1. Local knowledge
2. Risks and vulnerability assessments
3. Adaptation policy assessments

It is important to maintain a sound *LOCAL KNOWLEDGE* base of local climate change impacts and weak points in the system. Local knowledge is crucial for identifying local climatic stressors, but also interpreting these in terms of societal impact (Eriksen et al., 2011).). However, it is not just about the quantity of climate change research available to inform decision making, but more importantly its usability for decision making (Ford & King, 2015). Usability for the planning sector dealing with climate change adaptation increases when accurate information is available on the present and future situation to review whether or not certain adaptation options are suitable (Füssel, 2007b; Lemos, Kirchhoff & Ramprasad, 2012). When dealing with climate change related information, scientific analyses have to include as well natural as social science (Renn, 2008). Hanger et al. (2013) add to this that successful adaptation decision-making needs a broad practical and scientific knowledge base, which requires communication between scientific research communities, policy-makers and stakeholders to be useful. Mutually they reconcile the supply and demand side of adaptation knowledge (Hegger & Dieperink, 2014). This is also known as the science-policy interface (Pahl-Wostl, 2009; Hanger et al., 2013). The indicators for the criterion local knowledge are (1) the extent to which the system's vulnerability has been identified and translated to its societal impact, and (2) the extent to which both external technological and social knowledge are used mutually for adaptation planning

It appear to be imperative for climate change adaptation planning to conduct *RISKS AND VULNERABILITY ASSESSMENTS*. As Hunt & Watkiss (2011) argue, on a city-level the need for risk and vulnerability assessments is prevalent as climate change adaptation impacts are unique to the urban context or exacerbated in urban areas. Such assessments should be employed for "informing the development of policies that reduce the risks associated with climate change" (Füssel & Klein, 2006, p.303). As a guidance tool, the EU has developed the Adaptation Support Tool in 2015 (see figure 2.2.). After setting up the project and establishing a project basis, the first step is to conduct and risk and vulnerability assessment. Assessing risks and vulnerability will help identify opportunities arising from climate change, and provide information on how to assess adaptive capacity and cope with uncertainty (European Adaptation Support Tool, 2015). After a recent review of sub-national level risk and vulnerability assessments, Jurgilevich et al. (2017) conclude that there is no optimum assessment method. Rather ''multiple sources, taking into account a wide range of uncertainties, will provide a more robust understanding of change" (Jurgilevich et al., 2017, p.12). Assessment tools are more relevant and useful if there is large stakeholder involvement, the purpose of an assessment has been discussed and pathways approaches are applied (Jurgilevich et al., 2017). There should be strived for a good balance between scientific information and practical information. Decision-making is a more integrated approach that also includes institutional dynamics. It too often happens that the information is too climatic-centred. Then it loses usability for practitioners or decision-makers (de Bremond, Preston & Rice, 2014). Two indicators are used to measure the criterion: (1) execution of risk and vulnerability assessments, and (2) extent to which stakeholders are included to give meaning to risks and vulnerability assessments outcomes

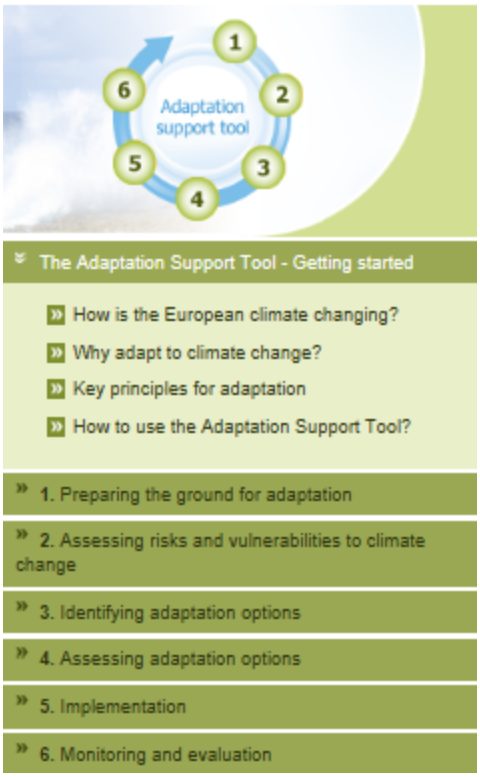


Figure2.2. Steps of the Adaptation Support Tool; source European Adaptation Support Tool, 2015

Climate knowledge does not readily translate into action. Climate change adaptation knowledge can be used in *ADAPTATION POLICY ASSESSMENTS* for its predictive value in policymaking if employed well (Amundsen, Berglund & Westskogh, 2010). Usage of such knowledge for decision-making is covered in as well multiple scientific sources (Bulkeley, 2000; Füssel, 2007b; van Nieuwaal et al., 2009; de Bremond, Preston & Rice, 2014), such as professional organisations (European Climate Adaptation Platform, 2015; IPCC, 2001, 2007). For example, the Adaptation Support Tool (2015) has included 'assessing adaptation solutions' as the fourth step. Here information resources also play a crucial role as input for the assessment tools, which in turn, are employed for decision-making regarding climate change adaptation (European Climate Adaptation Platform, 2015). Füssel (2007b, p. 270) claims that there are three distinctive stages of assessments; first climatic assessments on biophysical climate change impacts, then a vulnerability study on the impact of climatic impacts on urban areas, and thirdly an adaptation policy assessment should be executed for recommending specific adaptation measures. Generally, accurate and valuable information supports decision-making processes of the planning sector (van Nieuwaal et al., 2009).

A commonly known assessment tool is the cost-benefit analysis, which is developed to analyse several policy options by monetising strengths and weaknesses. Moreover, there are, for example, capacity assessment, focussing on the ability of an authority to act; scenario analysis, which

sets out several policy options; multicriteria analysis, employed to make a decision based on multiple (conflicting) criteria; life-cost analysis, examining the life-span of a certain adaptation measures in costs; impact analysis; determining the impact of a certain climate change adaptation measures.

Füssel (2007b) argues that the following four groups are essential for adaptation planning and need to be included in adaptation policy assessments: scientists, practitioners, policy analyst and decision-makers. Increasingly external experts as consultants are hired to play the role as policy analysts or for their expertise on climate change adaptation (de Bremond, Preston & Rice, 2014). As for the previous criterion 'risks and vulnerability assessments', there should be a mix of stakeholders. The following indicators have been selected: (1) execution of adaptation policy assessments for spatial and/or adaptation planning, and (2) the extent to which stakeholders are included to give meaning to adaptation policy assessments.

Social learning

Besides information resources also social learning is a critical condition for adaptive capacity (Pahl-Wostl, 2009). Climate adaptation is not fixed now and will not be in the future. Rather, it is a discipline paired with changing assumptions regarding climate scenarios, adaptation responses, technical feasibility and perception on vulnerability levels (van Nieuwaal et al., 2009; Hanger et al., 2013). Gupta et al. (2008) therefore argue that learning should be encouraged through learning networks and organisational arrangements as evaluations and workshops. Social learning is conceptualised by Pahl-Wostl (2009) as three distinctive phases of learning: single, double and triple loop learning. Traditional policy cycle going from planning to implementation to monitoring without questioning underlying assumptions is single loop learning. Double loop refers to reframing the problem and the goal with the traditional planning cycle. Lastly, triple loop learning involves a more radical transformation of assumptions, organisational structure and regulatory frameworks. The more social learning processes are promoted, the higher the learning capacity will be. For the purpose of this research three criteria of social learning have been defined:

1. Collaborative learning
2. Evaluation of spatial and adaptation planning
3. Behavioural internalisation

The criterion *COLLABORATIVE LEARNING* is added since it is believed that collaboration between different governmental actors and organisations across scales is a prerequisite as climate change adaptation. It refers to the exchange of existing knowledge between stakeholders and the co-production of new knowledge between stakeholders (Hanger et al., 2013; Hegger & Dieperink, 2014). None of the stakeholders hold the optimum solution for climate change adaptation and they are mostly an expert on one aspect of the multidisciplinary issue of climate change adaptation (Pahl-Wostl, 2009).

Pahl-Wostl (2007) argues that different disciplines (citizen behaviour, infrastructure, institutional knowledge, climate change knowledge) are often mutually dependent, stabilising each other and in many cases can co-evolve. It is advised in literature that stakeholders have to co-produce as it enlarges and combines different kinds of knowledge for uncertain and complex problems, which can facilitate the implementation of policy later on (Pahl-Wostl, 2009, p.357). Practitioners prefer contributing to the knowledge basis rather than solely receiving knowledge. This enhances the commitment of planning sector as they will become more included and develop a deeper understanding of the issues (Hanger et al., 2013). Armitage et al. (2011) have empirically tested if co-production of meaningful knowledge catalyses social learning. They found that important

changes on system understanding have occurred that have been induced by co-production of knowledge, and go beyond individual learning. Both researchers and policymakers have started to intensify efforts to co-produce knowledge that is valuable to both communities, particularly in the context of climate change adaptation (Hanger et al., 2013; Lemos, Kirchhoff & Ramprasad, 2012).

Collaborative learning is also induced by cross-stakeholder learning. This is assumed to be crucial for learning in a public policy context, as the interaction among actors and their understanding of different perspectives lead to a more comprehensive evaluation. Cross-stakeholder learning is fostered by sharing experiences (Tschakert & Dietrich, 2010; Armitage et al., 2011; Emerson, Nabatchi & Balogh, 2012). Indicators to measuring collaborative learning are (1) the extent to which stakeholders exchange knowledge regarding spatial and adaptation planning, and (2) extent to which stakeholders co-produce knowledge regarding spatial and adaptation planning.

Evaluation is regarded as an important step of adaptation planning in as well scientific literature (Renn, 2008; Tschakert and Dietrich, 2010) as reports by organisations (EU Adaptation Support Tool, 2015; Adaptation Futures Conference, 2016). The process of evaluation supports understanding of the adaptation process; performance, communicate lessons and improves future practice. Doing so, adaptation processes will evolve and improve each time (Hanger et al., 2013; European Climate Adaptation Tool, 2015). Moreover, adaptation requires high inputs in terms of resources and therefore it needs to be justified to governments in terms of efficiency (Tschakert & Dietrich, 2010 ;Adaptation Support Tool, 2015). Renn (2008) and Tschakert & Dietrich (2010) argue that evaluation should always be based on predefined criteria (goals, objectives, values) which are substantially more valuable than experiences and common sense. On the contrary, Klein et al. (2017) concluded after the Adaptation Futures Conference 2016 that evaluation should not solely be based on predefined goals and targets, but should be an ongoing process that couples with the iterative cycles of adaptation. Klein et al. (2017) advocate for more bottom-up approaches on local case studies that combine predefined goals with the narrative aspect of climate change adaptation with more focus on the process. The indicators are (1) the extent of formal procedures to evaluate spatial or adaptation planning, and (2) the extent to which an evaluation is based upon predefined criteria in terms of adaptation goals, objectives and values, yet providing room for narratives.

The criterion *BEHAVIOURAL INTERNALISATION* refers to the extent of which actors are taking effort to understand, react, anticipate and change their behaviour in order to effectuate climate change adaptation, and is being understood as an outcome of the learning process (Grothmann et al., 2013). Learning involves the encoding in organisational routines of lessons learnt from experience and leads to changes in organisational behaviour (Berkhout, Hertin & Gann, 2006). Grifford (2011) describes seven psychological barriers that hinder behavioural internalisation. Of the barriers 'limited behaviour', he identified 'tokenism' as a form when individuals choose a climate-related behaviour with little impact. This works as follows: some climate-related behaviours are easier to adopt than others, but still, may have little effect. Under the simplicity of choosing the easier one, a suboptimal option is adopted and other actions are disregarded or postponed under the perception that there is already a 'win'. In some pilot studies, almost all individuals agreed that they could do more (Grifford, 2011). To measure the strength of behavioural internalisation two indicators are formulated: (1) extent to which lessons learnt or experiences are reported for future use, and (2) the extent to which lessons learnt and experiences employed and lead to demonstrable changes in behaviour of stakeholders regarding adaptation planning.

Table 2.5. Operationalisation of learning capacity summarised

Learning capacity		
Conditions	Criteria	Indicators
Information resources	Local knowledge	Extent to which local climatic stressor have been identified and this is being updated
		Extent of technological and social knowledge are combined and used for adaptation planning
	Risks and vulnerability assessments	Execution of system risk and vulnerability assessments
		Extent to which stakeholders are included to give meaning to risk and vulnerability assessments
	Adaptation policy assessments	Execution of adaptation policy assessments for spatial and/or adaptation planning
		Extent to which stakeholders are included to give meaning to adaptation policy assessments
Social learning	Collaborative learning	Extent to which stakeholders exchange knowledge regarding spatial and adaptation planning
		Extent to which stakeholders co-produce knowledge regarding spatial and adaptation planning
	Evaluation	Existence of formal procedures to evaluate spatial or adaptation planning
		Extent to which an evaluation is based upon predefined criteria in terms of adaptation goals, objectives and values, yet providing room for narratives
	Behaviour internalisation	Extent to which lessons learnt or experiences are reported for future use
		Extent to which lessons learnt and experiences lead to demonstrable changes in behaviour of stakeholders regarding adaptation planning

2.3.6 Overview of planning capacities

From an extensive literature review five planning capacities were derived: legal capacity, institutional capacity, social capacity, resource capacity and learning capacity. Within these planning capacities, thirteen conditions were identified which aim to comprehend influential factors to the mainstreaming of climate change adaptation into spatial planning. Subsequently, all of the conditions were further elaborated into criteria, which have indicators to measure the criteria. This list is not definitive, but is gradually further defined in accordance to insights from empirical research. The research set up for the empirical data gathering is set out in the following chapter 3, which is logically followed with the case studies.

Chapter 3 Research methodology

As introduced in chapter 1, this research is designed around the main research question:

WHICH PLANNING CAPACITIES CONTRIBUTE TO MAINSTREAMING OF CLIMATE CHANGE ADAPTATION INTO SPATIAL PLANNING?

The previous chapter answered this question theoretically, but further empirical data is required to give more meaning to the capacities in light of mainstreaming climate change adaptation into spatial planning. The following chapter discusses the applied research methods and accompanying data collection methods for the empirical research according to the sequence of the research framework (figure 3.1). The first part (developing an evaluation framework through extensive literature search) has been executed in the previous chapter 2. The remainder consists of a cross-national comparative case study. This chapter is separated in four sections. In section 3.1 the choice for a cross-national comparative case study is explained. Second, the case selection is presented in section 3.2. In section 3.3, the data collection and analysis are elaborated upon. In the final section 3.4, the implications of the chosen research methodology with regard to internal and external validity are discussed.

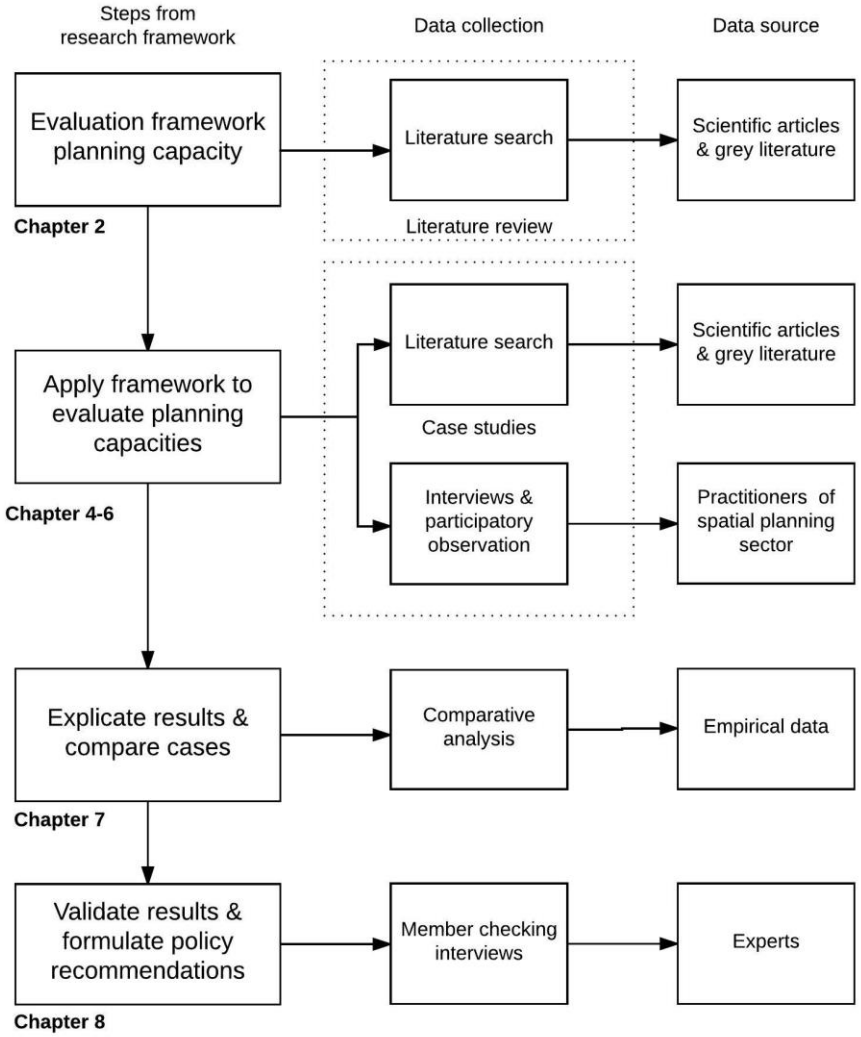


Figure3.1 Overview research data collection method

3.1.Cross-national comparative case study

A cross-national comparative case study was the chosen methodology for this qualitative research. By implementing this methodology, a profound understanding of different processes and social-economical forces that are in place and how they relate to each other within the boundaries of the case (Verschuren & Doorewaard,2010; Yin, 2013). Bryman (2008, p. 54) prescribes a case study for settings where a "researcher is concerned to elucidate the unique features of the case". Cross-national comparative case study research refers to a study where several interrelated international cases are intentionally compared on particular issues, taking into account their different socio-cultural settings (Bryman, 2008; Verschuren & Doorewaard. 2010; Yin, 2013). This approach is useful when the research aim is to "seek explanation for similarities and differences or to gain a greater awareness and deeper understanding of social reality in different national contexts" (Bryman, 2008, p. 58), as is the case for this research. A cross-national comparative case study research design is common in spatial and adaptation planning studies. It is often used to see how a planning sector deals with climate change adaptation across national contexts with different socio-cultural patterns and different spatial planning practices. Comparing cases allows for a researcher to understand under which circumstances a theory or assumption will hold or not. This, in turn, can be employed to stimulate further policy development (Bryman, 2008; Yin, 2013).

For the purpose of this research, a cross-national comparative case study is the most appropriate strategy because multiple case studies allow for an in-depth analysis of the planning sector in three European cases. The local planning capacity is the object of evaluation, i.e. the extent to which the planning sector has the capacity to mainstream climate change adaptation. In a cross-national comparative case study, the differences and similarities can be observed, i.e. which planning capacities to mainstream climate change adaptation appear to be of relative importance compared to others.

3.2 Case selection

Bulkeley (2010) showed that climate change adaptation governance is a complex process which requires a reconfiguration of political authority between public and private actors. Planning sectors within a city were selected as the object of study. The planning sector were chosen as they encompass a broad spectrum of actors which are involved with spatial planning. Each actor has different interests, resources, agendas and perceptions on climate change adaptation, but together, these actors will determine whether or not climate change adaptation will be mainstreamed into spatial planning. This makes the spatial planning sector, as the overarching term for all of the relevant actors, the legitimate terminology when analysing climate change adaptation in the context of a city. As mentioned earlier, the focus is on new projects, as this provides a valuable opportunity for urban actors to provide an encouraging framework or stimulating context to mainstream climate change adaptation into spatial planning.

First several general criteria were developed to identify possible cities where the projects could be investigated. Generally, all the cases had to represent European democratic cities, situated in developed countries with functioning governmental institutions. The cities face somewhat similar climate change impacts. In all cases climate change adaptation planning has been decentralised to the local or regional level. As mentioned earlier, climate change adaption planning generally has three distinctive phases; understanding, planning and monitoring. Of these, the planning phase appears to be the most challenging (Uittenbroek, 2016). For this research cases were chosen that are in the planning phase. Furthermore, all cases have a Sweco office in the city, which was used as a

base for conducting fieldwork. Lastly, it was aimed to pick cases that represent different stages in their advancement of adapting to climate change within the planning phase of the adaptation cycle. This means that the chosen cities have expressed the ambition to mainstream climate change adaptation but differ in levels of climate change adaptation in practice. This allowed for maximum variation in conditions and criteria that determine the planning capacities. When differences were found in the empirical data at hand, they could then be marked as influential factors to the process of mainstreaming climate change adaptation into spatial planning (Verschuren & Doorewaard, 2010). This led to the following six potential cases:

- Gothenburg, Sweden
- Hamburg, Germany
- Utrecht, the Netherlands
- Edinburgh, the United Kingdom
- Gdansk, Poland
- Poznan, Poland

Following to this, the cases were discussed with Sweco Netherlands employees to pick the most suitable case studies. Of the three cases, Gothenburg and Hamburg are the most advanced with climate change adaptation, having set clear climate change adaptation targets and integrated it in several policy documents. Utrecht and Edinburgh represent the second most advanced cases. Specifically for Utrecht, actors have announced the ambition to include climate change adaptation measures in spatial planning processes, but the explicit targets or solutions have not yet been stipulated. The city of Edinburgh has adopted a climate adaptation action plan in 2016, but is now searching for projects to implement the strategy. Two cities in Poland where added as less advanced cases with respect to climate adaptation into spatial planning. In Poland, the ambitious 44MPA project has been initiated to developed Urban Adaptation Plans for the 44 Polish cities with more than 100.000 inhabitants. Gdansk is a coastal town with some climate adaptation measures to prevent coastal erosion. In Poznan, climate change adaptation is new to practitioners of the spatial planning sector and not understood by everyone as their responsibility.

Subsequently, search was conducted within these cities for relevant projects where climate adaptation has a role. A contact person within Sweco helped with delineating potential cases as they operate within these European cities. Therefore, the Sweco contact could identify relevant projects within these cities and relate them to the different levels in advancement of climate adaptation within these projects. Hamburg has the prestigious Hafencity, but this project is already too advanced. Edinburgh lacked an urban development project to focus on. The city of Gdansk focusses mainly on coastal protection and the surrounding rural land, lacking interesting insights on their urban development in relation to climate change.

Therefore, three projects in three European cities were systematically chosen for the focus of this research. These three projects will further elaborated in the following case studies (chapters 4-6):

Merwedekanaalzone, Utrecht, the Netherlands

Frihamnen, Gothenburg, Sweden

44 MPA project Poznan, Poland

3.3 Research methods and data collection

The following section builds upon the research methods and data collection methods. Figure 3.1 on the previous page combines the research methods and data collections with the research framework (figure 1.2 in section 1.4.2). Research methods are discussed according to the sequence of this model, leaving out the development of an evaluation framework as this has been executed in chapter 2. Thus this section starts with the research methods used to evaluate the planning capacities for each individual case.

3.3.1 Evaluating planning capacities per case

Evaluation of the planning capacities of a spatial planning sector to mainstream climate change adaptation was done based on a triangular method. By using a triangular method, a profound understanding of the case was established and cross-checking of data was made simpler (Bryman, 2008). No data source was prioritised, but all data sources were included to enhance the understanding mainstreaming climate change adaptation into spatial planning. First, prior to and during the fieldwork period, an extensive literature search on policy documents, reports and scientific literature was conducted. Annex 1 provides an overview of the reviewed documents. Second, in-depth interviews were conducted with practitioners of the spatial planning sector, i.e. representatives that are involved with spatial planning in the chosen cases. For the purpose of this research, this was delineated to representatives from municipalities, consultancy/engineering firms, non-governmental organisations (e.g. a water board), property developers and researchers. The interviews covered most of the spatial planning sector that is working with climate change adaptation. In addition, some informants were found through snow-ball sampling. The interviews were designed to acquire in-depth knowledge and were semi-structured. The interviews took an hour or longer and were usually one-to-one, apart from 5 group interviews. In such cases there was, for instance, a workshop or meeting with a project team. It was not possible to interview more respondents from the same organisation and discipline within the available time given in all the three cases. It would not necessarily strengthen the findings of the research, because interviewing one property developer does not provide insights in how other property developers address oneself to climate change adaptation. See appendix 2 for an overview of the 31 interviews that were conducted. With the consent of the respondents, this list shows the name of the respondent, their job title and the organisation which they represent. For each case, 10 or 11 interviews were organised with about 3 or 4 municipal officials, 1 or 2 researchers, 1 consultant and 1 landscape architect per case. If possible, an interview was planned with a property developer or a representative from civil society.

As mentioned, the interviews were semi-structured, allowing respondents to elaborate on certain topics or ask follow-up questions by the interviewee (Bryman, 2008; Verschuren & Doorewaard, 2010). Each of the interviews required a slightly different approach as the respondents differed in organisation which they represent and disciplines. Each respondent was deliberately chosen to highlight a certain aspect of the planning capacities to mainstream climate change adaptation. For instance, an interview was held with a municipal urban water maintenance employee. This interview had a different structure than the interview with a project leader of urban development projects or an area director, both from the same municipality.

The interview guide for the semi-structured interviews is presented in annex 3. Each interview was recorded and summarised; available upon request. Analysing the interviews was done with the use of NVivo11. A total of 13 labels were created to allow a systematic analysis of the 31 interviews; one for every condition. As statements and paragraphs from the interview sometimes

address multiple criteria from one condition, the decision was made to create labels for all conditions rather than criteria. This decision provided a better line of argumentation per condition rather than criteria isolated. Following, a list of all the encoded statements and paragraph per condition were printed out and further divided into the criteria from the evaluation framework. See section 2.2 on pages 16/17 for the evaluation framework with the planning capacities with their conditions.

Chapters 4-6 provide the case studies. Each chapter has the same structure. Frist, a general introduction is provided with demographics and general information on the city. Then in the following section the climate change impacts on the city are elaborated. In the third and final section the governance arrangements will be discussed on a national, city and project level.

3.3.2 Case study comparison

In order to ensure a consistent comparison of all cases, the evaluation framework applied following a strict structure, i.e. per sub-capacity and its conditions. Each section on a planning capacity concludes with a table that presents an overview of all the conditions and criteria per case. Moreover, the main similarities and differences are included. In order to further assess and compare the cities, all criteria are 'graded' on a simple scale. See figure 3.2 for the 'grading scheme'. Grading is based on all of the gathered information for the case study explorations and interviews (chapter 4-6: case studies). A detailed comparative description of the criteria across cases is provided, followed with a table that synthesises the grading of criteria of a planning capacity across cases. The grading is meant to highlight the main similarities and differences in efforts of planning sectors in the cases to mainstream climate change adaptation into spatial planning.

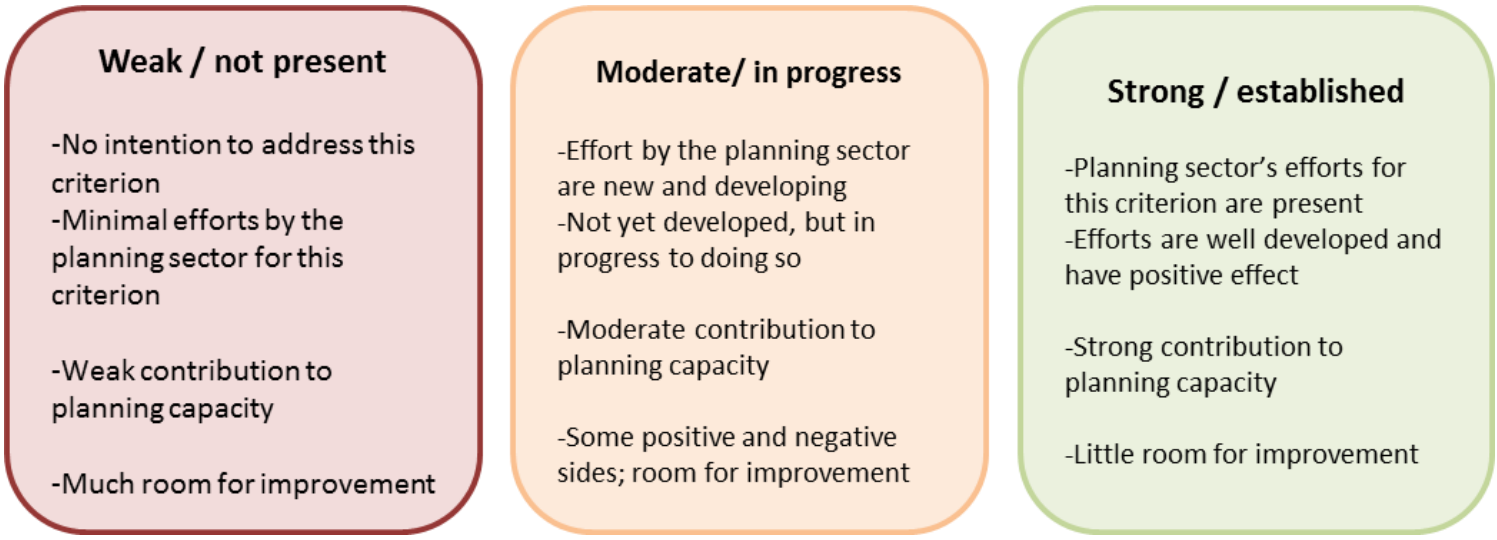


Figure 3.2. Grading scale used to evaluate and compare the cases on their planning capacity to mainstream climate change adaptation into spatial planning

The design of the grading system has three major benefits. Firstly, it allows for an internal evaluation of the case study. It provides a nuanced indication of where the city is in regards to climate change adaptation and what potentially needs improvement. As the analysis goes deeper to a low level of sub components, the analysis allows for a very targeted evaluation of the planning capacities. Secondly, using the same evaluation framework based on a clearly operationalised set of criteria allows for an inter-case evaluation. It indicates where a case excels compared to others or where case study lags behind. Thirdly, based on the previous point, by comparing the case studies, trends in certain planning capacities and its components could be identified.

3.3.3 Validating results and formulating policy recommendations

As a last step, in the final period of the research project three member checking interviews were conducted as validation of the preliminary findings. As mentioned in the knowledge gap, it is to be expected that some of the conditions and criteria of planning capacities are of more importance than others, depending on the context (Gupta et al., 2010). Conditions and criteria of planning capacities have thus far been given equal weighting. By bringing preliminary conclusions back to practitioners a deeper understanding and explanation of contextual varieties was established, as suggested by Gupta et al. (2010). Moreover, it highlighted whether or not the interpretation of preliminary findings provides a good picture of social reality and check the completeness of the findings (Ritchie et al., 2013). Similar to the stakeholder interviews, three respondents from different organisations and disciplines were approached. The respondents were confronted with six statements based upon the preliminary findings from the comparative analysis. Respondents were asked to respond to the statements. The reason to employ member checking interviews is twofold: it highlighted the relative importance of the topics that were included in the statements and it pinpointed were the focus was of the respondents, which helped drafting policy recommendations at the end of this research (Ritchie et al., 2013).

3.4 Internal and external validity

The following sections expands upon the implications of the research design for the degree of internal and external validity. Although qualitative research commonly has an inherent disadvantage that the findings are hard to generalise (low external validity), some strategical choices were made to improve the external validity. Firstly, by applying triangulation of sources and methods combined with a validation of preliminary findings there is aimed to get a broader insights in patterns of planning capacities to mainstreaming climate change adaptation. Doing so, the findings are made more generalisable (Verschuren & Doorewaard, 2010). Secondly, the framework is designed to be applied on different cases to evaluate the planning capacity to mainstream climate change adaptation into spatial planning. By systematically developing and applying an evaluation other comparative studies can then be executed in time and space (Runhaar, et al., 2012). Thirdly, as described in the previous section, strategic sampling of cases was applied. Applying the results in other contexts will add most value in similar cases, i.e. medium-sized European cities which have expressed the will to implement climate adaptation into spatial planning, but lack some capacity to implement on a wide scale. Results do presumably not apply to forerunners in climate adaptation, such as Rotterdam and Copenhagen, because they are not in the planning phase of the adaptation cycle. Then different contextual factors might play a role in the mainstreaming of climate adaptation into spatial planning.

Verschuren & Doorewaard (2010) stated that findings from a qualitative case study will be more easily accepted by practitioners in the field, when compared to findings from a quantitative research with a lot of cases. This statement is in line with the societal relevance of this research, to provide useful information for practitioners to potentially reorient or alter their current practices regarding mainstreaming climate change adaptation.

A high degree of internal validity is established by the comparative-case study design which allows an in-depth analysis of the cases. With a deliberately developed evaluation framework some detailed conclusions can be drawn. As mentioned before, conditions and criteria in the evaluation framework were treated as sensitising concepts. This further enhanced the internal validity as the concepts were constantly considered in their relation to planning capacities to mainstream climate change adaptation into spatial planning (Bryman, 2008; Verschuren & Doorewaard, 2010).

Chapter 4 Case study: Frihamnen in Gothenburg, Sweden

In the following chapter the case study Frihamnen in Gothenburg, Sweden will be introduced and thoroughly discussed. As mentioned earlier, each case study (chapter 4-6) have the same structure. First, a general introduction is provided in 4.1. Then in section 4.2 the climate change impacts on the city are elaborated. Section 4.3 sets out governance arrangements on a national, city and project level regarding spatial and adaptation planning.

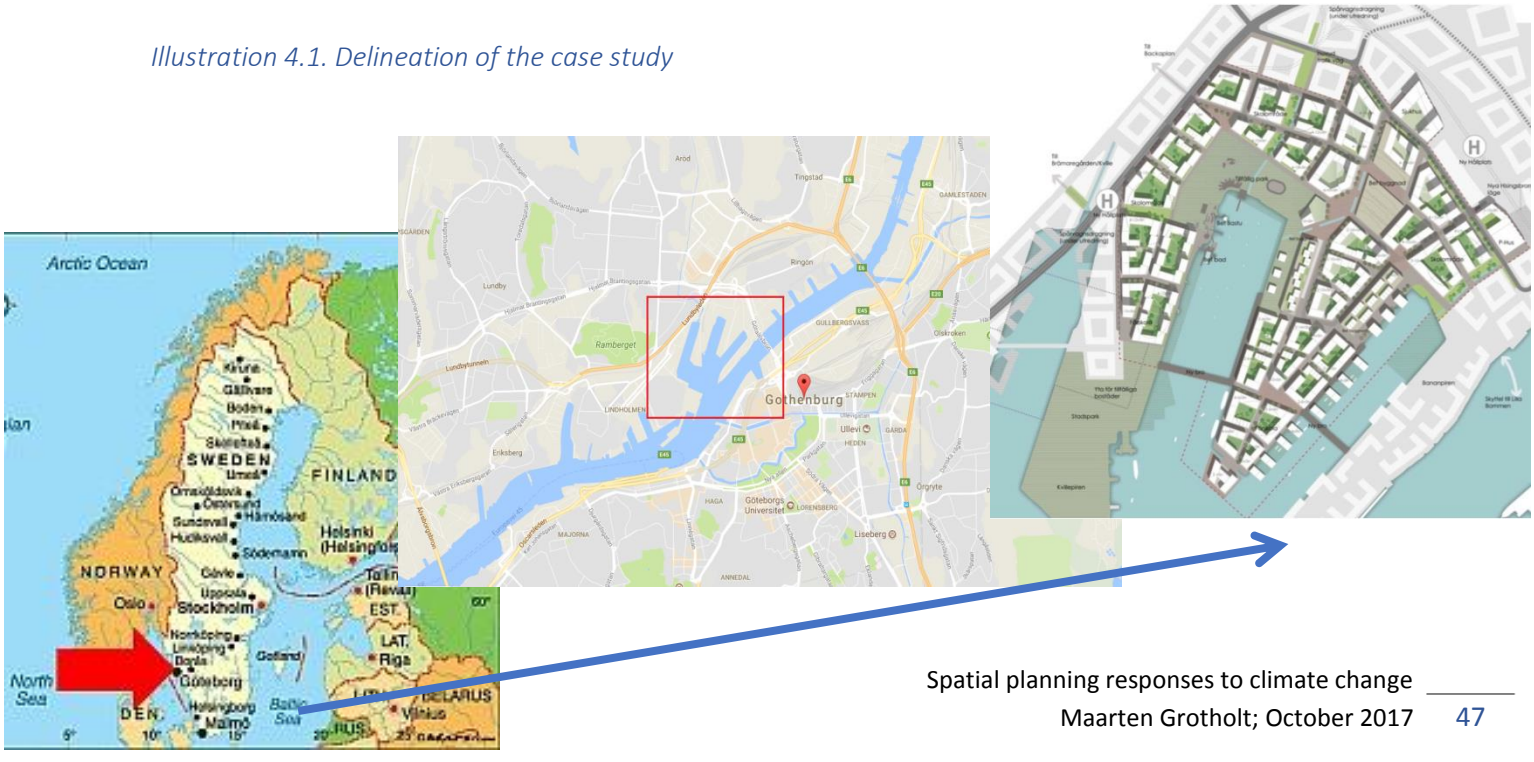
4.1 Introducing the city

Gothenburg (Göteburg in Swedish) is with 548.000 inhabitants Sweden's second biggest city and located on the west coast that connects Sweden to the North Sea (City of Gothenburg, 2015). The city is home to Scandinavia's biggest international port and has two universities with over 50.000 students. In total the municipality of Gothenburg covers 722 km^2 of which 271 km^2 is water. Sweden's longest watercourse, the river Klarälven to the Göta River, flows through the city to the North sea (Swedish Geotechnical Institute, 2012; Simonsson et al., 2011)

Currently, Gothenburg houses 550.000 inhabitants and is rapidly growing. Urban planning is adapted to an expected growth of 150.000 more inhabitants by 2035. This trend of growing cities is visible in all Sweden's the big cities. In the UN World Urbanisation Prospect, it is estimated that 84% of the Swedish population is living in cities, more than 10% higher than the European average (United Nations Department of Economic and Social Affairs, 2014).

To facilitate the growth, Gothenburg has formulated various strategies. The most ambitious one is the vision Rivercity Gothenburg which sets out development goals for seven connected and adjacent districts in the old harbour of Gothenburg. All the areas are close to the city centre along Gota Alv. It therefore has been labelled as a potential extension of the city centre with high quality houses (City of Gothenburg, 2012). Of those seven areas, Frihamnen (or Freeport in English) has the highest growth target. Once fully developed, it has to be a vibrant and inclusive area with at least 15.000-20.000 inhabitants (Alvstranden Utveckling, 2014 or 2015). In the first phase 3000 houses and 2000 workplaces have to be completed. This planned for 2012, the city's 400th anniversary (Älvstranden Utveckling. 2014 of 2015). The Frihamnen area is the case under investigation within Gothenburg, see illustration below.

Illustration 4.1. Delineation of the case study



4.2 Climate change impacts

In 2007, the Commission on Climate and Vulnerability highlighted changes in temperature and precipitation as the two major climate change impacts on Sweden (Swedish Commission on Climate and Vulnerability, 2007; Simonsson et al., 2011). First the changes in temperature will be discussed, followed by a section on changes in precipitation. The last paragraph will address the local impacts of sea level rise, which is a main concern for Gothenburg (Ek et al., 2016).

Regarding changes in temperature, temperature will increase more in Sweden and Scandinavia than the global mean. There has been estimated that the average Swedish temperature will increase by 3-5 degrees by the end of 2080. This is paired with an increase of heat waves and drought periods. It has furthermore been estimated that the costs related to heat waves and droughts comprises almost 50% of the total damage expenditures in Sweden due to climate change (Commission on Climate and Vulnerability, 2007). Locally in Gothenburg, the increase will be in between 4-5 degrees (Swedish Geotechnical Institute, 2012). Thorsson et al. (2011) have extensively researched the thermal conditions in Gothenburg and concluded that the extent of extreme heat stress will increase by 20-100 hours per year at the end of this century. At the same time, however, this there is a stronger decline of 400-450 hours per year in extreme cold stress. According to Thorsson et al. (2011), this improves Gothenburg's outdoor climate during winter, spring and autumn.

With respect to changes in precipitation, the strongest increase in Europe is in Scandinavia and Western Russia. In the region of Gothenburg, by the year 2100 precipitation will be increased by 20-30% (Swedish Geotechnical Institute, 2012). It is to be expected that there will be more rainfall in winter, autumn and spring. During the summer the downpours will be more severe than before (Swedish Commission of Climate and Vulnerability, 2007). In urban areas, these heavy downpours can result in pluvial flooding when storm water and sewerage system do not have the capacity to cope with the rainfall. Besides pluvial flooding, Gothenburg is also prone to fluvial floods as it is built along the low-lying river banks of the Göta River (Ek et al., 2016).

The Göta river valley main soil type is clay. Heavy rainfall and fluctuating water levels can radically change the stability of the clay soils, with some damaging landslides as a result. An increase in precipitation due to climate change does therefore also implies a higher risk of landslides in the future. There have been three landslides in the Gota valley which claimed several lives (Sirte, Götä and Tuve; 1950, 1973 and 1997, respectively), but many more incurred high societal costs (Swedish Geotechnical Institute, 2012; Commission on Climate and Vulnerability, 2007).

In Gothenburg, sea level will rise by 0.15 m by 2050 and up to 0,7 m by 2100. These numbers have taken land uplifts of a 3 mm rise per year in Gothenburg into consideration (Swedish Geotechnical Institute. 2012). Gothenburg will experience pressure from the sea when there are low-pressure moments and strong westerly and south-westerly winds can lead to coastal floods in Gothenburg (Swedish Commission on Climate and Vulnerability, 2007; Ek et al., 2016).

Research by Gelin (2015) on floods in the Gothenburg area showed that pluvial floods are most likely to occur. Although these floods are generally of short duration, they can seriously affect society in terms of damage to buildings and paralyse mobility due to flooded infrastructure. Sea level rise, however, will be one of Gothenburg's future challenges as it will permanently rise. In the worst scenario, the city has to cope with coastal, fluvial and pluvial floods simultaneously, with plausible devastating effects on the city of Gothenburg (Ek et al., 2016; Gelin, 2015; Swedish Geotechnical Institute, 2012).

4.3 Governance arrangements

4.3.1 Climate change adaptation planning in the Sweden

Sweden has been one of the first countries to implement a number of environmental policies, specifically that address pollution and climate change mitigation. Glaas (2013) concludes in his doctoral thesis on climate change adaptation in Sweden, however, that climate change adaptation is underrepresented at the national level in Sweden. Initiatives for climate change adaptation are relatively new in Sweden compared to other western European countries like the United Kingdom and the Netherlands. It was in 2007 by the Commission on Climate and Vulnerability that climate change adaptation was mentioned for the first time on a national scale. A report dating from October 2007, *Sweden facing climate change – threats and opportunities*, was the first major initiative to identify climate change impacts for Sweden. Among other recommendations, this report stated that Sweden needs to address climate change adaptation more by analysing several European initiatives (Glaas, 2013; Dymén & Langlais, 2012; Keskitalo, 2010).

Based on the results, the national government reorganised the instructions for some national authorities with respect to climate change adaptation. There is no national authority with an overall responsibility, rather about 30 authorities jointly hold responsibility for prevention, improving skills and knowledge for climate change adaptation (Glaas, 2013). In general, national government's climate change adaptation efforts are characterised by voluntary activities and knowledge generation and dissemination (Storbjörk & Hjerpe, 2014; Glaas, 2013). Below are the four examples of national authorities provided with their actions on climate change adaptation, which are according to Lundqvist (2016) the most important (Glaas, 2013, Lundqvist, 2016; Simonnson et al., 2011; Keskitalo, 2010):

- Swedish Environmental Protection Agency (EPA); responsible for monitoring and reporting of adaptation and mitigation efforts.
- The Swedish Meteorological and Hydrological Institute (SMHI); suppliers of scientific knowledge on climate change in Sweden. The Institute also coordinates several other authorities that generate and disseminate knowledge under the umbrella of the national climate adaptation centre, established in 2012 on behalf of the national government.
- The National Board of Housing, Building and Planning; provides regulatory guidance in terms of handling flood risk related to planning and building.
- Swedish Civil Contincuincy Agency; responsible for public safety and civil protection. This entails taking measures before, during and after an emergency of crisis.

The multitude of national authorities that work with climate adaptation can be explained by the fact that there is a lack of national guidance. Sweden is one of the few European countries that does not have an overarching national adaptation strategy (Glaas, 2013; Biesbroek et al., 2010). There is a national integrated energy and climate policy (2009) with a section on climate change adaptation, stating that adaptation efforts must be strengthened and sectoral addressed. Glaas (2013) found that only one adaptation measure has been implemented under guidance of the national government by 2013, which was the foundation of the climate adaptation centre.

From a legal perspective, there are two major legislations on a national scale. Firstly, there is the Swedish Environmental Code, dating from 1998. The code is legally grounded, but lacks detailed regulation. It can rather be regarded as a handbook with environmental values for decision-making. The code is drafted for everyone in society to jointly pursue sustainable development (Granberg & Elander, 2007).

Besides there is the Planning and Building Act from 1987. Based on the Commission on Climate and Vulnerability's report (2007), the national government revised the Act. The new Act (2010) was complemented with the statement that municipalities have full responsibility to take climate change into consideration when planning new areas. The commission concluded that the municipalities already regulate planning and construction and climate change adaptation can best be positioned under municipal jurisdiction (Commission on Climate and Vulnerability, 2007; Kesikalo, 2010; Glaas, 2013). Doing so, climate change adaptation in terms of spatial measures was decentralised to municipal planning. It is believed that spatial planning is the valid instrument to consider climate change adaptation from a planning perspective (Storbjörk & Uggla, 2015; Glaas, 2013). A representative of the City Planning department finds the lack of national guidance troublesome as some of the climate change transcend municipal boundaries, such as potential storm flood barriers. However, in May 2017 a new report called 'Who is responsible' again underlined that municipalities and landowners are responsible for climate adaptation action. No extra actions are coming from the national government (interview municipal official)

In between the national government and municipalities are the County Administrative Boards and County Councils as regional authorities. The latter hold elected office and are responsible for health care and public transport. Councils within the bigger regions, including Gothenburg, hold extra responsibilities for a Regional Spatial Plan, describing future regional development strategically. However, these lack a legal status (Dymén & Langlais, 2012; Nordregio, 2016). According to a municipal official can the County Administrative Board be regarded as the National Government's regional representation. Through financial, legal and supportive tools, the County Administrative Board oversees if national programs get implemented at a local level (Nordregio, 2016; Storbjörk & Uggla, 2015).

Regarding climate change adaptation, the County Administrative Boards have been assigned a coordinating role in the last 5 years. Their role in this respect is mostly about providing, interpreting and communication climate change adaptation knowledge to municipalities. In 2013, County Administrative Boards were obliged to develop regional adaptation strategies (Glaas, 2013). Besides, they execute regional climate change impact assessments and are responsible for collection, synthesising and disseminating information. However, according to representatives from the County Administrative Board, the city of Gothenburg excels in climate action compared to the regional efforts. This is because Gothenburg assigns more resources to tackle the issue than surrounding smaller municipalities. A legal role the County Administrative Board has to fulfil is evaluating whether a particular development plan is in line with the national Planning and Building Act. With respect to climate change, this relates to the dangers of flooding. The first evaluation is formulated as a recommendation. After the second version of a development plan is being published, then the authority can block further development if they judge the plan not to be in line with the Planning and Building Act (Antonson et al., 2016; Storbjörk & Uggla, 2015). In Gothenburg the County Admnistrative Board temporarily blocked further development of the harbour area Lindholmen because no proper measures were taken to protect the area against sea level rise.

4.3.2 Climate change adaptation planning in Gothenburg

Sweden's 290 municipalities have three official documents were climate change adaptation could be included: Municipal Comprehensive Plan (MCP), Local Detail Plan (LDP) and granting of building permits (PBL). Through the formulation of a Municipal Comprehensive Plans, municipalities extrapolate their long-term development projections and land-use targets. These have to be updated every 4-5 years. Such plans are not legally binding, but sets out the long-term development and land-

use targets (Storbjörk & Hjerpe, 2014; Eliasson, 2000). Municipalities must formulate more detailed specifics for building requirements in Local Detail Plans. They specifically focus on the area's suitability for urban development and to sets out design guidelines. Detail plans can be initiated by individuals or companies (Ek et al., 2016; Lundqvist, 2016). Unlike the Comprehensive Plans, the regulations set in a Detail Plan are legally binding for about 5 years. It is commonly the City's Planning Department responsibility to develop Detailed Plans (Eliasson, 2000; Lundqvist, 2015). The Comprehensive Plans serves to secure climate change adaptation measures in Detailed plans at a project level, which in Swedish context mostly addresses flood risks and landslides (Lungqvist, 2016). Figure 4.1 sets outs the differences between Comprehensive plans and Detail plans.

Planning processes in Sweden are based on democratic values and therefore both the Comprehensive Plan and Detail Plan must go through a public consultation round. The opportunity to influence the planning process is open for anyone; municipal departments, external organisations and citizens (Eliasson, 2000; Antonson et al., 2016). The city's Planning Department is responsible for these documents. Together with other municipal department they form the Planning and Building Committee. They are responsible for the Development Strategy 2035, which highlight development goals for the whole city based upon the perspectives from all municipal departments. The composition of this committee is dependent on the topic (interview municipal official).

Box 2.1: Examples of proposed adaptation measures for planning and building

Measures in comprehensive plans:
- ✓ Account of protected areas, such as water protection areas
- ✓ Identification of flood risk areas
- ✓ Recommendations for how stability and ground conditions should be considered in detailed plans

Measures in detail plans:
- ✓ Disposition on the plan area
- ✓ Basin, cofferdam, embankment
- ✓ Ditches
- ✓ Prohibition of basements
- ✓ Plus elevation
- ✓ Facade materials

Figure 4.1. Examples of adaptation measures in MCPs and LDPs
Source: Ek et al., 2016

Additional to these legal instruments, the city of Gothenburg specifically has developed the vision Rivercity Gothenburg to describes the planned development along the Gota River. After a two-year period with multiple workshops, the vision was officially adapted on 11 October 2012 by the City Municipal Board. Under this vision, it is being aimed transform the huge growth challenge into opportunities for the future (City of Gothenburg, 2012). The Vision Rivercity Gothenburg (2012, p.23) states: "Water should be an asset in the urban environment". For this purpose, they will "ensure access to the riverbanks and canals for everyone" and "create a network of small green spaces linked and build a green corridor through Frihamnen". Moreover, one section called 'use climate adaptation as a driving force' sets out the attack, retreat and defend strategy that will be applied to protect the city against rising sea levels. Furthermore, public spaces will be designed in a way that rainwater will enrich the area (Rivercity Gothenburg, 2012, p.26-27). Three strategies have been put into place to support the vision (City of Gothenburg, 2012, p.7):

- connect the city; bring the north and south side of the city together across the river to become one physical and social entity;
- embrace the water: make water a permanent feature of urban life and an asset to everyone;
- reinforce the centre: include all actors in the making of Gothenburg by incorporating knowledge and ideas of all actors.

The municipal company River Bank Development Inc. (Älvstranden Utveckling) oversees the development of the north and south shore of the river Gota and is, together with the City Planning Department in Gothenburg, responsible for the implementation of the vision Rivercity Gothenburg. The company is operational since 1970 because the city has started dismantling the harbour gradually due to severe international competition (interview employee information centre Älvstranden Utveckling).

To inform citizens on the urban development plans of Gothenburg the city has opened an information centre called Alvrummet. Here a maquette is displayed and additional information is presented be displayed. Furthermore, theme discussions are organised, called soup meetings, to engage community and anyone who is interested with the development plans.

To further enhance community participation, on Gothenburg's website and in the information centre Alvrummet, citizens, businesses and other interested can, with the use of a 3D model, see the effects of climate change on Gothenburg. It visualises flood events from the sea, rivers and rainfall (Blomquist, 2015).

4.3.3 The development of Frihamnen

The following section provides a clear overview of the development of Frihamnen in Gothenburg by discussing spatial and adaptation planning.

Spatial planning in Frihamnen

After the Vision Rivercity Gothenburg, the development programme Frihamnen was published in 2014. This document outlines the development targets for the area. Älvstranden Utveckling (Riverbank Development inc, a municipal owned development company) and the Planning Department together formulated regular requirements for development. Based upon this document, property developers were invited to join the planning process in December 2014. The selection procedure was ended in February 2015 and followed with an official consortium agreement of seven chosen property developers. Several respondents indicated that there were 70 plus applications, which was beneficial for the municipality as they could safeguard a level of proficiency. The consortium is under guidance of Älvstranden Utveckling. The first Local Detailed Plan was published in December 2015 and was developed through a continuous dialogue with all the stakeholders. Therefore, several workshops were organised during the summer of 2015, all addressing different topics of the development. These were summarised in a document from September 2015. Included was the manifest containing 12 headlines that reflect the future development of Frihamnen which all stakeholders agreed upon. According the project leader, this manifest underlines the shared development targets among stakeholders and ensures consistency in time. It describes what Frihamnen is about from a strategical point of view. One point highlights that Frihamnen is a test area for both the novel planning process that includes many stakeholders in the designing process and for novel planning principles in the area including adaptation solutions. Moreover, another point of the manifest is framing water as an integral part of the area. Parallel to this the illustration plan, a visualisation of the proposed plans, was developed (see Illustration 4.2).

Consultation time for this first version was from January 20th until March 1st 2016. Comments have been processed and the second version has been made public in September 2017. This Local Detailed Plan is was for the whole Frihamnen area. As mentioned in the introduction, however, the development of Frihamnen has been divided into phases. The first 1000 houses and workspaces have to be finished in 2021, the city's 400th anniversary (Älvstranden Utveckling. 2014). The second Local

Detailed Plan for phase one of Friahmnen will be published at the end of October 2017. Once adopted it will have a legal status. Building has to start in 2019 (interview project leader).

Thus far all the property developers were invited to participate in the development of Frihamnen without knowing what exactly they will be developing. They knew their share and focus (retail, social housing, luxurious apartments) of the development, but not which part of the area they will be developing. Land allocation will be done after the Local Detailed Plan for the first phase has been officially adopted. According to the project leader and a municipal official, this has to ensure that all property developers supported the plans for the whole area and not purely pursue the highest gains for their individual plots. A property developer agrees that it stimulates cooperation and doing so the area as a whole, including public spaces, will be of high quality. Finances public space are for the property developers. This has not yet been determined, but respondents are positive that there will be sufficient resources and practitioners are motivated as they co-designed the adaptation solutions.

Because Frihamnen used to be a cut-off harbour area, citizens cannot relate to the area yet. Based upon this observation the city of Gothenburg initiated 'Jubileumsparken'. This is a project to already generate some city life in the area prior to, during and after the urban development. It will continue to evolve and change to and beyond the city's 400th anniversary in 2021. Thus far a swimming pool, roller skate area, urban gardens and sauna complex have been put into use (interview employee Älvrumnet).

Illustration 4.2. Status of Illustration Plan in May 2017
It outlines the division between public space and real estate, and locations of public facilities
The black line is the border of phase one which needs to be finished in 2021.
Source: Planning Department, 2017; line added by researcher

Climate change adaptation measures in Frihamnen, Gothenburg

Gothenburg is considered as one of the Sweden's forerunners on climate change adaptation, specifically with respect to flood events. This can be explained by their disadvantaged location as discussed in the previous paragraph, as the pressure on their housing market which makes them want to build in vulnerable areas (Keskitalo, 2010). It is inevitable that the Frihamnen area needs to be protected against sea level rise. As depicted in Illustration 4.3 the area is already prone to flooding and this will only increase towards 2100. According to a representatives from the City Planning Department are Frihamnen's ground levels between +2,0 and +2,5 m, making the area prone to flooding. This also accounts for the areas Kvillebäcken, Ringö and Lundbyleden that surround Frihamnen.

Illustration 4.3. Flooding in meters when there is maximum tide in 2014 (left) and in 2100 (right)
Source: local detailed plan Frihamnen, phase one; City Planning Department, 2016

As a solution the ground will be elevated. This will be complemented with even higher main roads that can steer rainwater to the Göta river and to make sure that the Frihamnen area is always accessible. It will be a mixture of the attack, defend and retreat approach. On Illustration 4.2 (previous page) the honeycomb structure left indicated floating houses which is the attack approach and elevating the ground is the defend approach. The climate adaptation strategy from the first local detailed plan is presented in Illustration 4.4. The orange lines are main routes through the area where ground is elevated to 2.8 meters to ensure accessibility at time of high tide. The blue, green and yellow line indicate how rainwater is directed through the area.

As mentioned earlier, water has been framed as an asset rather than a treat. According to a representative from the Water and Recycling department, it therefore needs to be visually present in the area and not put away in a drainage system. Rainwater is therefore targeted to be stored and processed within the area. Therefore, open surface solution in the form of canals are incorporated in the planning process. As this is a novel idea, the proper solution to include it has to be developed. This was organised in a series of workshops dedicated for this. Five municipal departments are included:

1. Planning department; responsible for detailed development plans, building permissions and the comprehensive plan
2. Nature and Park administration; responsible for public spaces
3. Water and Recycling office; responsible for drinking water, sewage system and storm water
4. Traffic department; responsible for riverside protection
5. Real estate office; responsible for municipal owner land

According to a respondent from the municipality, this highly fragmented approach hampers designing proper adaptation measures. This is underlined by the team working for the Water and Recycling office: “everybody is working with climate adaptation, and at the same time nobody is really working with climate adaptation”. Nevertheless, a series of workshops have also contributed to establishing a shared understanding of the issue at hand and the proposed adaptation solutions. As it is unclear which department will carry responsibility for maintenance and damage caused due to storms it works best to jointly design the adaptation measures that everyone supports (interview municipal official).

The initial target was to capture 100% for the rainwater, but gradually it was found that this would not work from the start as open canals hamper building and construction traffic in the area. There will be a minor pipe system to support the local drainage and storage (interview team from Water and Recycling office).

Although it is new and the lack of responsibilities sometimes lead to unstructured work, the project has won a price for the organisational set up. According to a municipal officials, it is praised for the inclusions of businesses, community and the municipality to make Frihamnen an ecologically responsible and socially inclusive area (interview Planning Department).

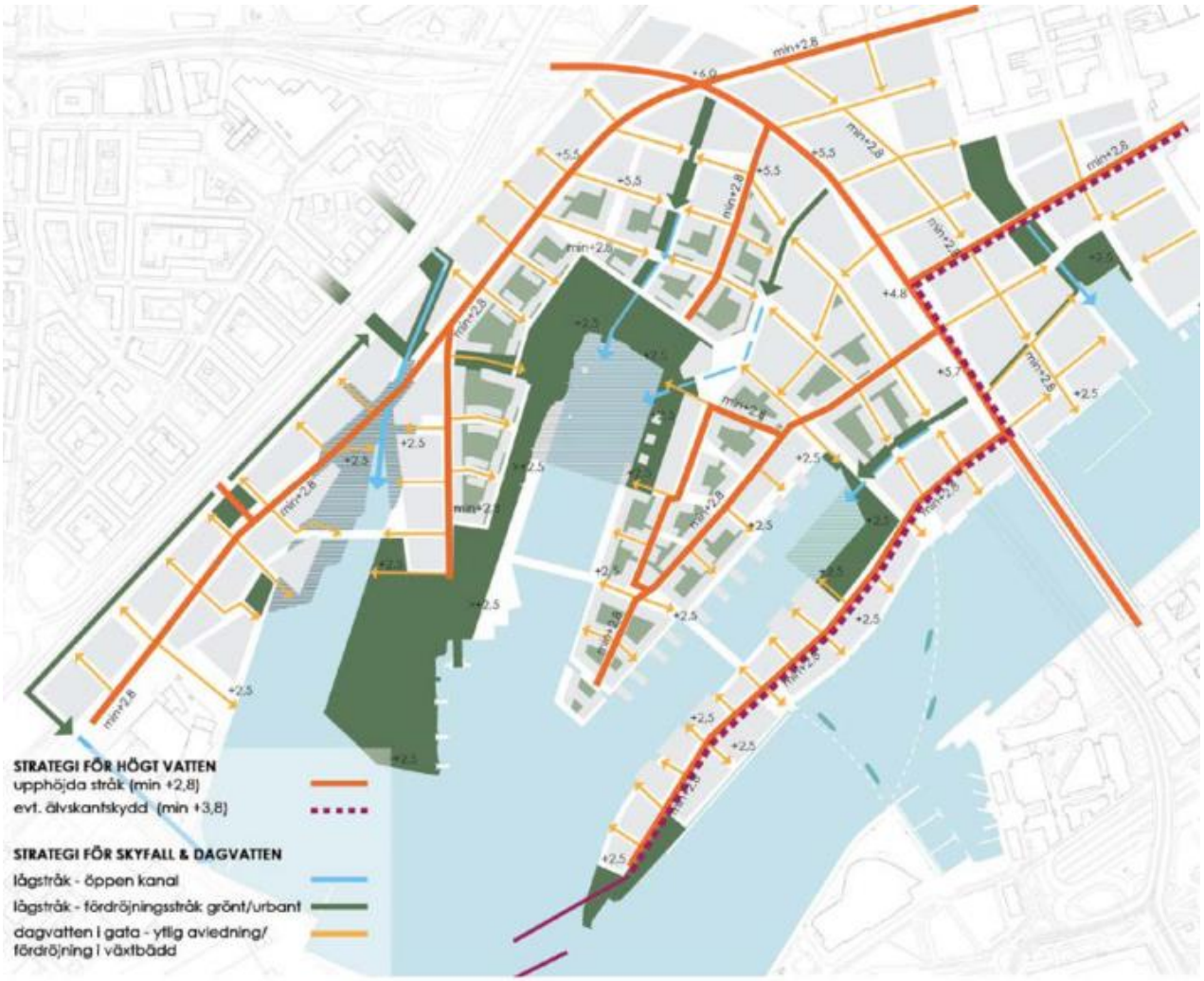


Illustration 4.4. Climate adaptation strategy for Frihamnen
Source: Local Detailed Plan Frihamnen, phase one; City Planning Department, 2016

Chapter 5 Case Study: Merwedekanaalzone in Utrecht, the Netherlands

In the following chapter the case study Merwedekanaalzone in Utrecht, the Netherlands will be introduced and thoroughly discussed. First, a general introduction is provided in 5.1. Then in section 5.2 the climate change impacts on the city are elaborated. Section 5.3 sets out governance arrangements on a national, city and project level regarding spatial and adaptation planning.

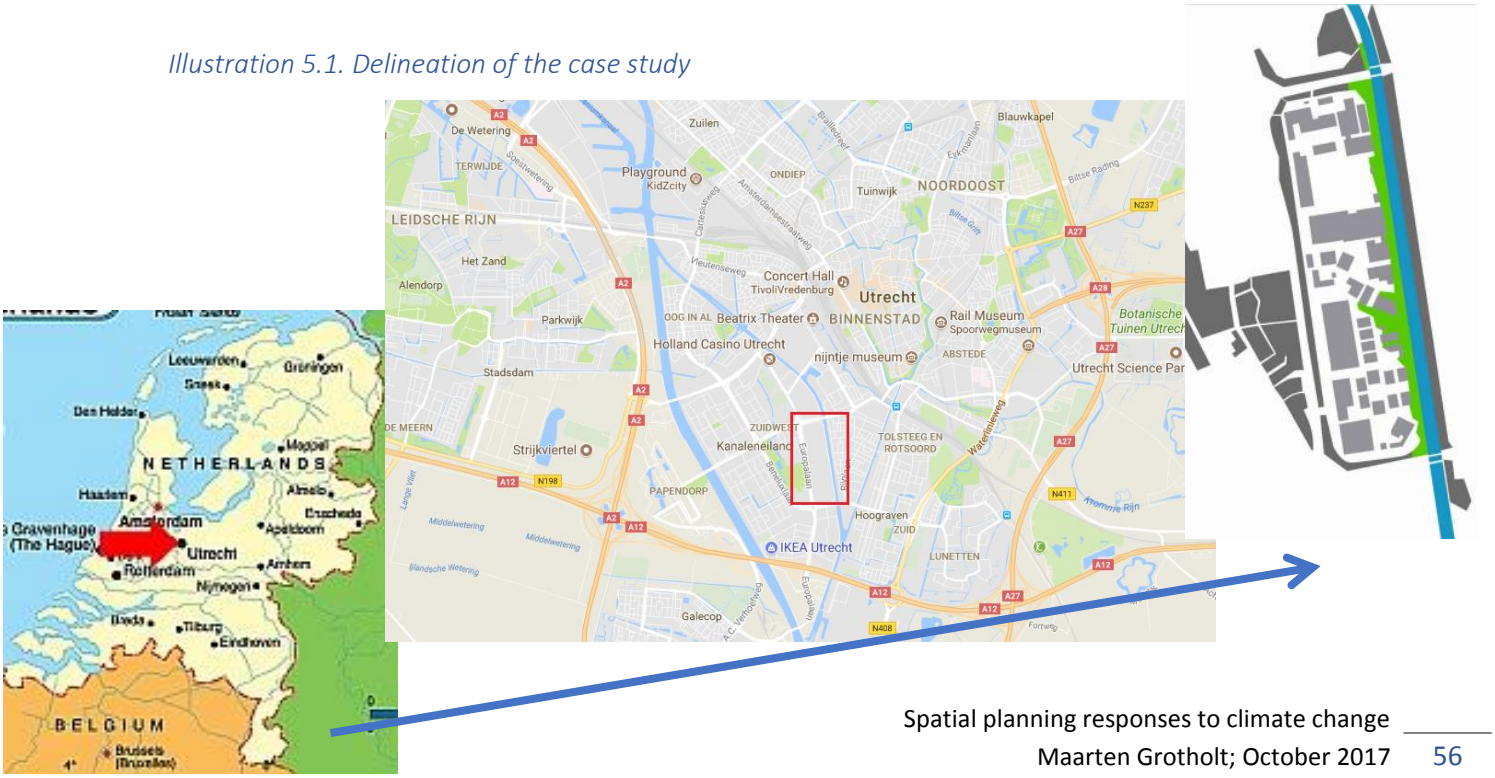
5.1. Introducing the city

The city of Utrecht is located in the centre of the Netherlands and is the capital of the Province of Utrecht. It lies in the Dutch urban agglomeration (Randstad) and is as only big city within the Randstad adjacent to three different rural/green areas. The Amsterdam-Rhinecanal is the world's busiest canal and goes through the city. It was put into service in 1952 to unburden the Merwedekanaal. Moreover, the rivers the Vecht and Kromme Rijn flow through the city. The city is known to be relatively high educated, which is partly explained by the presence Utrecht University and Utrecht School of Applied Sciences. Moreover, it is the central 'travel hub' of the country for as well railways, highways as rivers (Buizer, Hendriks, Kruse, Schenkels, & Buizer, 2015).

With 343.134 inhabitants (January 1st 2017) it is the fourth biggest city in the Netherlands (City of Utrecht, 2017). Utrecht is a popular city to live. Forecasts indicate that the city will grow up to 400.000 inhabitants in 2027 (City of Utrecht, 2017). There has been chosen to facilitate this growth through intercity development (City of Utrecht, 2004). To supporting such growth four inner-city areas where pinpointed to grow substantially: Merwedekanaalzone, the area surrounding the train station, Leidsche Rijn and Utrecht Science Park (City of Utrecht, 2016). Within Utrecht, the focus is on the development of Merwedekanaalzone, which is an old industrial area in close proximity of the city centre. Since industrial activities have left the area, it became of special interest for the city the facilitate its planned growth.

The area is located along the Merwedekanaalzone and forms an island together with the Amsterdam-Rhinecanal. For the whole area an estimate of 6.000-10.000 houses are planned that together will house approximately 9.000 till 14.000 citizens. Currently, 1.500 houses are inhabited (City of Utrecht, 2016). Developing the area has been divided in 5 subarea of which subarea 5 is the biggest development plan. This sub-area is the focus of this study, see illustration below.

Illustration 5.1. Delineation of the case study



5.2 Climate change impacts

The Royal Dutch Meteorological Institute published climate scenarios for the Netherlands in 2014, where four different scenarios are distinguished based on air flow pattern and global air temperatures (Royal Netherlands Meteorological Institute, 2014). This is widely accepted as a guiding authority regarding climate forecasting in the Netherlands. Therefore, these scenarios are consulted for this research. First, temperature changes will be discussed, followed by forecasts regarding precipitation and high flows.

All scenarios show an increase in temperature between 1 and 2,3 C by 2050. The highest increase is in wintertime and smallest during spring (Royal Netherlands Meteorological Institute, 2014). In the Netherlands, the increase was twice as high as the global mean since 1950, however, the local increase has by now equalised with the global mean (Netherlands Environmental Assessment Agency & Royal Netherlands Meteorological Institute, 2015). Higher temperatures can lead to periods of drought, affecting agricultural, public health, state of the dikes, water quality and water resources (Royal Netherlands Meteorological Institute, 2014). It has been estimated that there is an increase of 13% in deaths during a heat wave in the Netherlands (Wuijts, S. Vros, C. Schets, F.M., Braks, 2014)
Locally in Utrecht, a strong urban heat island is observed with differences over 5C between the city and its rural surroundings. Also, the number of tropical nights, when temperatures do not drop below 20C, increased significantly. Heat stress is increasingly being recognised to have an impact on the urban comfort within the city of Utrecht (Klemm eta al., 2015).

The national mean of precipitation is expected to increase between 2,5-5% by 2025 and up to 5-7% by 2080. This trend is paired with dryer summers with more moments of excessive cloudbursts, whereas winters will have more rainfall (Royal Netherlands Meteorological Institute, 2014). There are small regional differences in the Netherlands; the highest increase is expected in the coastal areas. The city of Utrecht is on the country's mean (Royal Netherlands Meteorological Institute, 2010)

The city of Utrecht is below sea level so not directly prone to flooding. In the Dutch context providing water safety is the main climate change adaptation challenge as 60% of the land coverage is prone to flood risks (Kaufmann et al., 2016). The Dutch therefore have a long-standing history in defending themselves to flood that resulted in a low high urgency among citizens. Nowadays, the Netherlands has the highest flood defence standards in the world, with an expectancy of a flood event of once every 10,000 years (Kabat and Vellinga, 2005).

However, the city is prone to fluvial flooding from the river Lek. A breach in the dike would affect the whole city. In 2003 a dike breached in Wilnes, located in the region of Utrecht. Although this did not directly affect the city of Utrecht as it was not a major river, it did show that the dikes provide permanent safety. In periods of droughts the dikes may lose their strength (Kaufmann et al., 2016). Furthermore, the city is prone to pluvial flooding. No mayor events have affected the city , but during periods of heavy rain some areas are affected, causing damage to building and infrastructure (Utrecht Waterproof, 2016).

5.3 Governance arrangements

5.3.1 Climate change adaptation planning Netherlands

Due to the water-challenges the Netherlands has always faced in its history, the adaptation policies are strongly linked to the water management. Before the National Adaptation Strategy was developed in 2007, there were several water policies in relation to spatial planning. After two devastating floods in 1993 and 1995 the national government initiated the 'Space for the Rivers'

programme in 1996. This was focussed on reclaiming land along the rivers for water retention during periods of high flows.

The start of climate change adaptation planning was the initiation of the National Programme Adaptation Space and Climate (acronym ARK). This represented a joint programme between four ministries, the 12 provinces and more than 400 municipalities and 25 water boards (Biesbroek et al., 2014). It was developed to form an overarching programme that guides and initiates climate change adaptation action. They developed the first climate change adaptation strategy called 'Make space for climate' in 2007 (VROM, 2007). The goal was to have climate adaptation mainstreamed in policy by 2015. At that time, the strategy was considered as a starting point for a climate change adaptation agenda to raise awareness, develop knowledge and develop practical instruments (Biesbroek et al., 2014).

In accordance with the national adaptation strategy, a national-local agreement was effectuated in which Dutch municipalities committed themselves to the national targets (Hoppe, van den Berg & Coenen, 2014). The climate agreement was signed in 2007 with the national government, provinces and water boards. The agreement states that of all governmental levels, Dutch municipalities can best address climate change adaptation, because they have the closets connection with businesses and citizens, and can best stimulate local action. This shifted responsibility from the national government towards regional and local authorities (van den Berg, 2010).

Subsequently, the Delta programme from 2010 represents an extensive national programme that highlights the necessity to take drastic measures to prevent future disasters (van den Berg, 2013; Hoppe, van den Berg & Coenen, 2014). Water safety, fresh water supplies and spatial adaptation were put at the centre. This illustrates a shift from broad climate change adaptation policy, addressing public health, natural areas and infrastructure, towards a water management centred approach (van den Berg, 2013). As a sub-programme, the Delta Programme develops the 'Delta resolution Spatial Adaptation' with the ambition to have normalised climate change adaptation acting by 2020 in policy and practice, and to have a climate adaptive country by 2050 (Deltabeslissing Ruimtelijke Adaptatie, 2014). The Delta Programme has been given more political weight and is therefore further in the implementation that the National Adaptation Strategy from 2008 (Termeer, Biesbroek & van den Meer, 2012). A municipal official is more familiar with the Delta Programme and also regards this as the leading document. To support successful implementation the national government has installed a Delta Commissioner and Delta Staff to oversee climate change adaptation action (Veraart, Fontein & van Tol-Leenders, 2016).

A revised National Adaptation Strategy was instituted in 2016. It was developed to complement the Delta programme by preparing the Netherlands to all climate change impacts, fulfil EU policy (white paper on climate change adaptation, 2009) and identify business opportunities (Temeer, Dewulf & Biesbroek, 2016). The strategy distinguishes heat, drought, rainfall and rise sea level as the four main climate change impacts, and set them out possible impact sectors as agriculture, energy and nature (NAS, 2016). Furthermore it sets out six goals for the national government (NAS, 2016, p.30-38):

1. Increase awareness on the necessity of climate change adaptation
2. Stimulate climate change adaptation in practice
3. Utilise and expand the knowledge foundation
4. Address urgent climate risks
5. Institute climate change adaptation into policy and legislation
6. Monitor the progress of climate change adaptation policy

Recently, on September 19th 2017, the Delta Commissioner presented the Delta Plan 2018 which includes a plan specifically for Spatial Adaptation. Besides, there is also a Delta Plan for water safety and fresh water. The Delta Plan is a joint effort of national, regional and local governments and water boards to formulate concrete actions and goals for different governments. It states that before spatial adaptation was too non-committal, leading to big differences among municipalities, and therefore advocates for systematic monitoring. A major action is that all municipalities must have executed a local stress test before 2019 (Delta Plan Spatial Adaptation, 2017).

Regarding responsibility for water-related tasks, the Netherlands has 22 water authorities. These are since 1255 responsible for water safety, quality of fresh water and water resources. It is a democratic system which an elected council and own tax system. Though an independent authority, it has much in common with other governmental bodies and policies as spatial planning and environmental protection. From this perspective the concept of 'integrated water management' is often used to weigh decision in all the policy fields. This is stipulated by law, the Water Act; municipal and provincial plans in the field of spatial planning must be checked by the responsible water authority within the context of the Water Act. In practice this means that locations are evaluated on their suitability for urban development from a water management perspective, and the impact or urban development on water resources and quality (Havekes et al., 2017).

The national government has issued two major research projects in the past years. For the period 2004-2011 a research consortium was formed named 'Climate Changes Spatial Planning to investigate the effects of climate change in the Netherlands and explore how there can be coped with. Climate change adaptation was one of the five research topics (van den Berg, 2013). Additionally, the 'Knowledge for Climate' programme was initiated in 2008. This ran until 2014. The focus was on developing knowledge and services to assess spatial and infrastructural investments that foster climate resiliency (van den Berg, 2013). In the context of the 'Knowledge for Climate' research programme, the national government founded the non-profit organisation Climate Adaptation Services (CAS). They administer the platform Knowledge Portal for Spatial Adaptation, which provides information for governments, citizens and businesses to stimulate climate change adaptation in practice. Moreover, they developed the Climate Impact Atlases and Story Maps, and organise interactive working sessions for municipalities (Climate Adaptation Services, n.d.). Lastly, there is the programme Spatial Adaptation that organises theme meetings and brings together stakeholders (Stimuleringsprogramma Ruimtelijke Adaptatie, n.d.)

5.3.2 Climate change adaptation planning in Utrecht

The Province of Utrecht is responsible for comprehensive land use planning at the regional level. The Provincial Spatial Structure Vision 2013 -2028 mentions climate adaptation briefly as a future challenge. Legally, the province has the Provincial Spatial Regulation that imposes restrictions on the municipal land use plans. Changes in a municipal land use plan are evaluated against the parameters formulated in the Provincial Spatial Regulation (Buizer, 2015). In the plan a section is dedicated to climate change adaptation, stating that the Province will hold a stimulating role through knowledge generation and dissemination (revision Provincial Spatial Regulation 2013-2038, 2016).

A next level down, municipalities are obliged to make so-called Structure Visions. These bring together policy ambitions of different policy fields with respect to land use (Buizer, 2015). The Utrecht Structure Vision 2015-2030 dates from 2004. In addition, the city published the Spatial Strategy titled 'Utrecht chooses healthy growth' to set out inter-sectoral targets for the growth of approximately 40.000 inhabitants. In this document the city of Utrecht extrapolates on their vision

'Healthy urban living', constituted to accommodate healthy inner-city growth. It does mention climate change adaptation, but not does substantively elaborate on it (Ruimtelijke strategie, 2016). According to respondents, the concept of 'Healthy Urban Living' is now adopted as the overarching vision for the growth, but it lacks any specifics. Some find this beneficial to support local tailor-made work for every project, whereas other respondents find it too arbitrary. In the period 2014 until the beginning of 2017, according to respondents, climate change adaptation in Utrecht was determined by the motivation of a few, lacking a mandate.

In 2016, the city of Utrecht passed a bill for the public space that is developed for several municipal departments working within the public realm. Climate change adaptation has been defined in this bill as a contemporary challenge. Municipal departments adopted the bill and integrated climate change adaptation in their strategies. For instance, the multiple-year programme Green Structure Plan (revision 2017) introduces climate change adaptation as a new challenge for the green structure and elaborates on how urban green contributes to the adaptiveness of a city structure to climate change (Green Structure Plan, 2017). Plan Municipal Water Tasks 2016-2019 has also included climate change adaptation after a recent revision. Estimates by the municipalities state that 500-1000 houses experience damage caused by rainwater. Consequently, the municipality is running the programme Utrecht Waterproof to tackle this problem (interview with municipal official).

Furthmore, the city of Utrecht participates in two relevant partnerships with other municipalities or governmental authorities. The Coalition Spatial Adaptation started in 2014 between nine governmental authorities to jointly address big questions regarding climate adaptation. Moreover, for spatial planning the city of Utrecht takes part in U10. Here regional development targets are set out and an economic course for the region is drafted (interview municipal official).

5.3.3 The development of Merwedekanaalzone

The following section provides a clear overview of the development of Merwedekanaalzone, sub-area 5 in Utrecht by describing the spatial and adaptation planning.

Spatial planning in Merwedekanaalzone

Intentions to redevelop the 60 hectares large old industrial area Merwedekanaalzone are not new. Within this research the focus is on the largest of the sub-areas, namely sub-area 5 with 24 hectares. Within the area are six owners of which 3 investors, 2 property developers (BPD and Jansen-de Jong) and the municipality with the largest share. In 2011 the civil society group MeerMerwede started to stimulate the landowners to cooperate. Before they were planning individually on their plot. A landscape architect of MeerMerwede explained that the approach of MeerMerwede was to highlight the benefits of leading the transformation of Merwedekanaalzone from an industrial area into a highly valuable city area jointly. MeerMerwede published the 'development perspective Merwedekanaalzone' in 2012 were they outline their vision for the transformation. The phase of raising awareness at the landowners to develop cooperatively took a while. In 2015, the landowners formed a collective of owners which was officially captured in a declaration of intent in May 2016 (interview MeerMerwede). According to one of the property developers in the collective of owners, cooperation allows to formulate ambitions out of the area as a whole rather than independent plots. This supports more comprehensive and ambitious solutions that require a certain mass or land cover, such as public transport, energy grids and blue/green structures.

The collective of owners started off with a series of workshops to outline the developing vision in September/November 2016. This process was guided by the bureau Marco Broekman. Under their guidance the following step is to develop an urban plan. This is a planning document that

outlines the area the built up area roughly. It includes the share on types of housing, number of offices and retail, how public is is used and described urban amenties. Therefore they brought in six parties for expert knowledge: Stadskwadraat for the finances, Goudappel Coffeng for mobility , Merosch for the sustainability inquiries, Skonk for the communication and OKRA for the public spaces. The latter is most importance for the adaptation planning. According to an employee of Marco Broekman, there are meetings every two weeks with all the landowners. Every other week Marco Broekman meets with all the design bureaus that work on the urban plan.

Parallel to the urban plan, the city of Utrecht has developed an Environment and Planning Vision for the whole Merwedekanaalzone. This are total five sub-areas of which sub-area five is the largest. According to respondents are the two documents developed in close harmony. As sub-area is the biggest, most of the Environment and Planning Vision Merwedekanaalzone is mostly written towards the development ambitions of sub-area 5. The concept vision was published on June 22nd 2017. The municipality is currently processing comments from the public consultation.

After the urban plan is the basis for the 'programme of demands for houses' and the 'plan public space'. The latter one is where the area-wide adaptation measures are included. It is more refined than the urban plan, containing concrete measurements and designs of the public space.

The planning process in the Netherlands is based upon democratic values. Plans have to go through public consultation rounds. Inhabitants can object to decision in the planning documents. The responsible entity has to respond to all comments and objections in a public letter. In order to further engage actors within Merwedekanaalzone the city of Utrecht has initiated 'Creating the city together'. In the basis this initiative is meant for the four primary inner-city growth areas, but three have specifically been dedicated to Merwedekanaalzone. One session in May 2017 elaborated upon the plans that landscape bureau OKRA has for Merwedekanaalzone. Reactions were positive on the design It is open for anyone who is interested, but some actors are purposely invited because of their expertise. The sessions are used to receive feedback from actors to incorporate it into the urban plan before public consultation. (interview OKRA).

Adaptation planning in Merwedekanaalzone

In the Environment and Planning Vision Merwedekanaalzone climate adaptation is formulated as a challenge for urban areas and Merwedekanaalzone should be prepared for this. Respondents from the municipality call the climate adaptation targets ambitious. Illustration 5.2 is a thematic overview of the water issues and solutions. One of the main ambitions is to store more rainwater within the area rather than draining everything by infiltrating water into the soil, capture water at green roofs and providing more surface water. Greening of the area is stimulated to cope with heat stress in a highly dense area (Environment and Planning Vision Merwedekanaalzone, 2017).

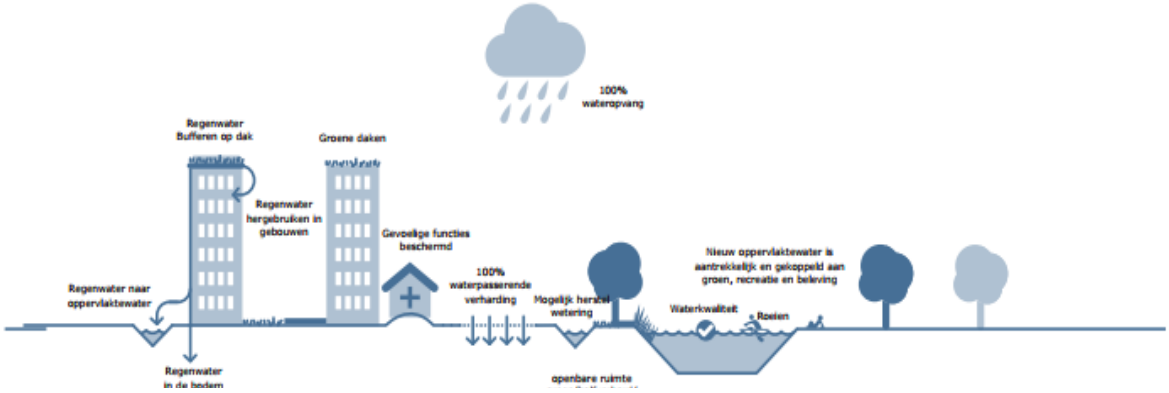


Illustration 5.2. Thematic overview of water challenges in Merwedekanaalzone
Source: Environment and Planning Vision Merwedekanaalzone; city of Utrecht, 2017

The Province of Utrecht used the inner-city development programme to start a project on design principles for climate adaptive planning. Interviewing two participates within this research learned that this provided novel and valuable know-how on how climate adaptation can and should be integrated into spatial planning. The project was led by bureau LINT and participants where governmental officials from the municipality of Utrecht and the local water authority. The focus was specifically on sub-area 5. However, as the respondents indicate, it is unsure to what extent their output will be used for the urban plan of sub-area 5. There is no legal basis for climate adaptation and designing the public space of Merwedekanaalzone is under the responsibility of landscape bureau OKRA. They were chosen through public tender. An employee from OKRA indicated that there given a mandate to ensure high quality of public space given the high densities. Some main principles at this point in the urban plan are the inclusion of a 'backbone', which is a blue/green structure that goes through the area and acts as a water buffer and green stroke. Moreover, some water squares are planned for water retention, but are also designed to steer social interaction.

For the financing of the public space there will be a budget based upon exploitation of the ground. Each landowner has to contribute money that is based upon their share of the whole area. As this is an area the required contribution is higher than usually. The project leader for sub-area 5 indicated that a municipality has to approve exploitation plan, only then a developer can start with developing. The municipality tries to do this for the whole area rather than individually per developer. The idea is to organise this in a public-private partnership, but this is as today not arranged yet. So according to respondents, the finances remain somewhat unsure.

Chapter 6 Case Study: Urban Adaptation Plan in Poznan, Poland

In the following chapter the case study the 44MPA project is introduced and thoroughly discussed. This is a nationally led project to develop urban adaptation plans for 44 cities with more than 100.000 inhabitants. Execution of this project is analysed within the city of Poznan. First, a general introduction is provided in 6.1 followed by section 6.2 on local climate change impacts. Section 6.3 sets out governance arrangements on a national, city and project level..

6.1 Introducing the city

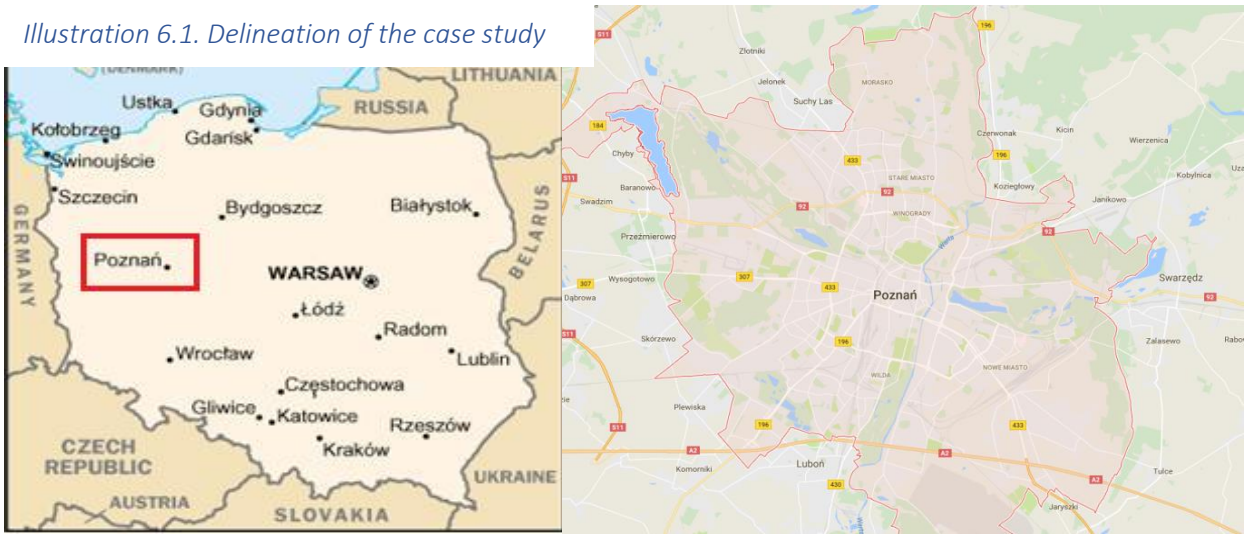
Poznan (Poznań in Polish) had 545680 inhabitants in 2016, making it the fifth biggest city in Poland (Statistical office in Poznan, 2017). The city spreads over 26 260 hectares and has a density of 2086 inhabitants per km^2 (Matczak et al., 2016). The city's population was at the highest around 1992 with 582290 inhabitants and has shrunken ever since. The decrease in population has been formulated as one of the city's major challenges in the Development Strategy for the city of Poznan 2013-2030 (City of Poznan, 2010). Although population numbers are still decreasing, the trend is flattening in the last three years (Statistical office in Poznan, 2017).

Poznan is located in the mid-west of Poland and stretches along the river banks of the river Warta. The Warta is approximately 808 km long and the main tributary of the Odra River. In the city of Poznan the river banks are being used as a green stroke for its citizens. This together with the many parks Poznan has, makes this one of Poland's greenest cities (Tönkö & Kronenberg, 2015; City of Poznan, 2012). Moreover, Poznan is located halfway between Berlin and Warsaw in the greater Wielkopolska Region, of which Poznan is the administrative capital (Tönkö & Kronenberg, 2015).

The city of Poznan is an important academic and university centre in Poland. With 251 students per 1000 inhabitants, students make up a crucial part of the population. In total there are 26 universities which includes 8 public universities (City of Poznan, 2010). Having recognised quality of education is a competitive asset in term of labour force (Favero, 2016). With about 19 thousand euro per capita, Poznan has the second highest GDP of Poland (Matzack et al., 2016).

In its longstanding history, the region has been under several administrations. The the Prussian annexation lasted from 1793 until its defeat in 1918. This is a period known as Germanisation of the area. Poland became independent after the First World War until the annexation by the Soviet Union at the end of the Second World War. The period of Sovietisation, characterised by imposing communist values, ended in 1989-1990 and ever since Poznan has been part of an independent Poland (Favero, 2016; Kundzewicz & Matczak, 2012).

Illustration 6.1. Delineation of the case study



6.2 Climate change impacts

Poland is with 311,888km^2 one of Central Europe's biggest countries. The climate is generally moderate but diverse over the country (Kundzewicz & Matczak, 2012). This paragraph will set out climate change impact on Poland and Poznan, with discussing firstly the temperature, then precipitation, followed be the occurrence of floods and lastly impact of heavy winds across Poland. There has to be noted, however, that climatic observations with long time series are rare in Poland due to the fact that is has not been an independent state for most of the last 220 years. Most of the statements regarding the Polish climate are therefore based upon historical reports (Kundzewicz & Matczak, 2012; KLIMADA, 2013).

Polish temperature has annual averages varying between 5C to 9C, with central and southern Poland having the highest average. Model-based projections show an increase of 3-3,5C by the year 2100 (Kundzewicz & Matczak, 2012). Two seasons can be distinguished in addition to the conventional spring, summer, autumn and winter; these are early spring and early winter (Ministery of Environment, 2013; Kundzewicz & Matczak, 2012). The duration of the seasons is heavily influences by the collision of four different air masses: polar air from the north, continental air from Russia, subtropical air from the south and maritime air from western Europe (Kundzewicz & Matczak, 2012). A variability of incoming air masses consequently leads to high variability in seasons in consecutive years (Kundzewicz & Matczak, 2012).

The Polish climate is warming up: the previous three decades were the warmest (8,7; 8,9 and 9,2C, respectively) compared to the period 1779-2000 with an annual average of 7,7 C (KLIMADA, 2013). For Poznan's climate, it is to be expected that in the period 2000-2030 the annual average will increase from 8 to 9C (The Ministry of Environment, 2013) and the increase of heat waves is most prevalent in the south-west and the area of Poznan (KLIMADA, 2013). Besides the increase of hot days, there is a parallel decrease of cold days in Poland, except for the mountain area in south-western Poland (Kundzewicz & Matczak, 2012; KLIMADA, 2013).

With respect to precipitation, an increase of 10% is to be expected nation-wide (Michalak, 2016). However, changes of precipitation differ across the country. While in the south-eastern part of Poland both the duration of dry periods (<1mm/day) and the duration of wet periods (>10mm/day) are increasing, the effect is reverse for the area surrounding Poznan (The Ministry of Environment, 2013). Although mean summer precipitation decreases in Poznan, intense precipitation is likely to increase (maximum 24 hours precipitation), meaning that extended dry periods can be interrupted by heavy rainfall (Kundzewicz & Matczak, 2012).

The increase in heavy rainfall will increase the change of flood hazards (Kundzewicz & Matczak, 2012). In Poznan three types of floods can occur. Firstly, Poznan had to endure several fluvial floods in the past due to high water levels. Poznan County has nearly 4 km of dikes along the rivers, but after an intensive research on flooding in Poznan county, Matczak et al. (2016) concluded that the dikes have deteriorated in the past decades and about 72% of the dikes required maintenance in 2010. The most recent flood of 2010 highlighted this maintenance gap.

An increase in the occurrence of very high wind speeds, lasting several hours or even days, has been observed. Although the changes are the strongest in central Poland stretched to the eastern border, thorough the whole of Poland the number of whirlwinds with wind speeds between 30 to 120 m/s has increased from 6 to 7-20 in the period 2008-2010 (The Ministery of Environment, 2013). In the period 2005-2013, a number of 11 hurricanes have been recorded with wind speeds periodically exceeding 30-35 m/s (KLIMADA, 2013).

6.3 Governance arrangements

6.3.1 Climate change adaptation planning in Poland

Poland's attitude towards the environment has changed over time. This can be tracked in the country's public policies. In the National Environmental Policy Programme from 1988 new goals to restore the deteriorated environment where formulated. The starting point was clear and frank: the Polish environment was in a deteriorated state because the national government has failed to protect it. This was followed by the National Environmental Policy from 1990 which was the first environmental programme in central and eastern Europe. Compared to western Europe counterparts, it could be considered as comprehensive and ambitious. It had to eliminate pollution sources and stimulate restoration efforts (Andersson, 2002). From the 2000s, however, environmental policies gradually lost popularity among political parties and the public and the focus shifted towards the state's economic situation (Kundzewicz & Matczak, 2012). Since Poland's accession to the EU in 2004, it has known a strong economic growth and the country's ambitions have been marked by the desire to rapidly catch up with the core of the EU in terms of economic growth and living standards (The World Bank, 2017). Current discourse is economic growth. This gets reflected in other policy documents too. For example, the NAS2020's main objective is to "ensure sustainable development and efficient functioning of the economy and society" (NAS2020, 2013, p.33).

With respect to committing to climate change reduction, in 1992 and 1998 Poland did sign respectively the United Nations Framework Convention on Climate Change (UNFCCC) Convention and the Kyoto Protocol. However, Poland hardly has developed any climate policies since. Furthermore, it actively tried to block the European Union's efforts to intensify actions against anthropogenic climate change (Kundzewicz & Matczak, 2012). In the realm of environmental policies, several researches makes some profound statements in terms of Polish government's efforts: "Poland has little regulation compared to the European Union member states" (Andersson, 2002, p.353); "environmental policy has been labelled as passive and rather driven by international agreements" (Kundzewicz & Matczak, 2012, p.303); "Poland is willing to catch up with Western Europe environmental standards but the legacy of inadequate environmental policy remains a problem" (Brouwer, Rayner & Huitema, 2013. p. 141); Poland remains an opponent of 'stepping-up' the EU reduction targets for emissions because its dependence on coal (Skovgaard, 2014); climate change knowledge plays a minor role in strategic studies and planning documents that are put into place (Degórska & Degórski, 2015).

Specifically regarding climate change adaptation, a National Adaptation Strategy was prepared by the Ministry of Environment in 2013 with the focus on adaptation toward 2020 and the prospect of 2030 (SPA2020). With the SPA202 the Ministry aims to "ensure sustainable development and the efficient functioning of the economy and society in terms of climate change" (Ministry of Environment, 2013, p.33). For this purpose, six objectives have been formulated (Ministry of Environment, 2013, p.33-48):

- Ensuring energy security and good environmental status;
- Effective adaptation to climate change in rural areas;
- Development of transport in terms of climate change;
- Ensuring sustainable regional and local development during climate change;
- To stimulate innovation and promote adaptation to climate change;
- Shaping social attitudes conducive to adaptation to climate change.

6.3.2 Climate change adaptation planning in Poznan

After the second World War Poland was under communist rule who replaced local governments by system of people's councils that were heavily subordinated to national Communist Party structures (Sakowicz, 2017). Municipalities were introduced by law in 1990. Currently, Poland has 2479 municipalities divided over 380 counties and 16 regions (Tönkö & Kronenberg, 2015). Municipalities have directly elected mayors and city councils, and the counties and regions have directly elected councils. Due to its size, Poznan also has county rights and therefore functions both as municipality as county. Municipalities are not required by law to develop climate change policies. However, as municipalities are responsible for environmental protection and health of its citizens, there are various policies that address the environmental issues (Klausen & Szmigiel-Rawska, 2017; Tönkö & Kronenberg, 2015). After sending out a questionnaire to all Polish municipalities, Szmigiel-Rawska (2017) finds that the label climate change is rarely used in public policy or by respondents. Even though climate action requires some cooperation, according to Sakowisz (2017) this is hard to achieve in Poland due to the legacy of the communist period in people's values, culture and behaviour. This has as a result that Poles are not willing enough to integrate and act on behalf of the common good. During an interview a municipal official labelled it as one of the major threats to climate change action in Poznan.

Relevant policies that might affect climate change adaptation are the Environmental Protection Programme and the Flood Directive. Regarding the Environmental Protection Programme, every Polish city is obliged to develop such a programme. The programme for Poznan dates from 2013 and is written for the period 2013-2016 with predictions to 2020. The main objective is to preserve the historic green wedge-ring system which includes hydrographical setting of the Warta river and its tributaries (Tönkö & Kronenberg, 2015). With respect to the Flood Directive, water safety is a centrally organised affair, but municipalities are obliged to developed strategies for flooding as spatial planning can prevent floods. Spatial planning is in Poland under the responsibility of regional and local authorities (Tönkö & Kronenberg, 2015). Through a hierarchical structure of seven relevant planning documents, which is stated in the Spatial Planning and Spatial Development Act from 27 March 2003, the national government imposes guidelines on regional and local authorities (Parysek, 2016, p. 39):

- National level – country spatial management conception
- Provincial level (regional) – spatial development plan
- Metropolitan area – a study of determinants and directions of spatial development of a metropolitan union area
- Provincial hub – a spatial development plan of the urban functional area of a provincial centre
- Regional level – a landscape audit drafted at least every 20 years, used a pre-planning study for regional spatial development plans
- Commune (local) level – studies of determinants and directions of spatial development of communes
- Local level – local spatial development plans.

Tönkö & Kronenberg (2015) have conducted a case study on spatial planning in Poznan with respect to urban green infrastructure and concluded that the most important instruments for land use are the Spatial Management Plan for the Wielkopolska Region and the city's Masterplan – study of determinants and directions of spatial development. The latter is the most comprehensive

document. It is not legally binding, but approved by local politics. The most recent version dates from 2014. The Masterplan elaborates on the usage of green areas; protecting health, promoting recreation, protecting water resources and soils. Poznan has one of the country's highest rate of local spatial development plans, which are developed in accordance with the Masterplan (Tönkö & Kronenberg, 2015).

Regarding community engaging in spatial or adaptation planning, The city of Poznan states to pursue public consultation, but public participation is not mandatorily by law on any planning documents. During the interviews it became clear that Polish citizens are not that concerned with spatial planning (Matzcak et al., 2016). Especially with relating to climate change there is little public awareness, so respondents believe that public consultation on the Urban Adaptation Plan would not be very useful.

A regional and local policy researcher, who was interviewed for this research, has researched the perception of local governments on climate change in Poland in 2017. She concludes that climate change related issues are weighted to their economic impact rather than social safety and environmental protection. Moreover, climate change adaptation is a matter of phrasing. In her study on Polish municipality's perceptions on climate change, Katarzyna (2017) concludes that climate change is rarely traced back in official documents. During an interview, it is emphasises that there are obviously several policies and measures in practiced that relate to climate change, but this not labelled as such.

6.3.3 Development of Urban Adaptation Plans for Polish cities

National context

As became clear in the previous section, the discourse was characterised as environmental protection and restoration rather than climate change adaptation. Adaptation to climate change was affirmed as important for the first time by the Polish government in March 2010 as a respond to the European Commission's White Paper on climate change adaptation (2009): "Adapting to climate change: Towards a European framework for action'' (Michalak, 2016). Simultaneously, the UN's three-year programme on drafting an adaptation framework for the COP in Cancun, Mexico put climate change adaptation on the national agenda (44MPA, n.d.[a]). The Ministry of Environment correspondingly initiated the KLIMADA project in 2009, short for "Development and implementation of a strategic plan for the adaptation of areas and sector vulnerable to climate change". The project run from 2009 until 2012, resulting in a strategic adaptation plan for sectors and areas sensitive to climate change by 2020, with the prospect of 2030 (44MPA, n.d.[b]).

The former Polish Government initiated a project in 2013 to stimulate climate action on the local level by supporting all the Polish cities with the formulation of a climate change adaptation strategy. Therefore, in the period 2013-2015 the Ministry of Environment developed a report on the investment guidelines for climate change adaptation and resiliency and the Institute for Industrial Ecology drafted "adaptation manual for cities". These served as a basis for the project "Development of adaptation plans for climate change in cities over 100 thousand residents", which started in 2015. The work will be carried out in accordance with the methodology developed by the consortium and will be applied on all 44 partner cities (44MPA, n.d.[a]).

In April 2017, a national consortium has been formed and with that the focus shifted from preparation to execution of the project. The formal end date is January 2019, but planning is to be done in June 2018 because of local elections in November 2018. According to respondents, having the strategies finished before this may lead to incorporation of the strategy in the new city councils.

The Ministry of Environment, department of Sustainable Development is the project owner. The partners working on the project are:

- The Institute of Environmental Protection – National Research Institute (consortium leader);
- Institute of Meteorology and Water Management – National Research Institute;
- Institute of Ecology and Industrial Areas;
- Arcadis;
- Deloitte, subcontractor for communication and promotion.

The total of 44 cities have been divided over the partners. In the basis does the consortium team do all the work in terms of gathering data and executing assessments. Each city is asked to develop a municipal team with officials from different departments. Illustration 6.2 provides an overview of the project steps. There are three formal moments when the consortium team meets the municipal team for verification and discussion on their work. This is after step 2, 3 and 5. On each of the partner cities, the same approach is being applied. At the time of the interviews (May/June 2017) the project was at the start of step 2 'susceptibility assessment' At this moment (October 2017), the project is at the end of step 3 'risk analysis'[2]. The phases will shortly be elaborated (based on figure # and interviews with consortium partners):

1. Process start: this was an informal session where the consortium team was introduced to the municipal team.
2. Susceptibility assessment: here different sectors in a city (infrastructure, health, sewage, etc.) are assessed on their susceptibility to climate change. Each sector, in turn, is divided in categories. For example public health has categories as number of elderly, kids younger than five, etc. The categories are scored on a scale from 0 till 4. In a workshop with the municipal team the four most vulnerable sectors are identified. These will be used in step 3.
3. Risk analysis: this is defined as the susceptibility of a sector related to the ability to adapt. To determine the ability to adapt a list of questions for the municipal representatives was developed. There are seven categories with five questions each: financial possibilities, social capital, information and warning system, public institutions for health and education, experience with community and surrounding municipalities cooperation, protection measures for a town's ecosystem, equipment/instrument for adaptation, R&D activities. The consortium members interpreter the results. This will be presented for the municipal officials during a workshops to jointly decide on the risks to climate change.
4. Adaptation option development: there is no standardised method for this but is based upon judgements of the experts from the national consortium.
5. Option evaluation and selection: this step is executed through another workshop with the municipal officials. The municipality is asked to invite 25 stakeholders for this workshop. This can be representatives from research institutes, governmental authorities, businesses and civil society.
6. Document preparation: the consortium team prepares the Urban Adaptation Plan. This is then handed over to the municipality which can adjust points and then present it to city council for adoption.

[2] Therefore one more skype interview was held with the project team from the Institute of Environmental Protection on September 28th 2017.

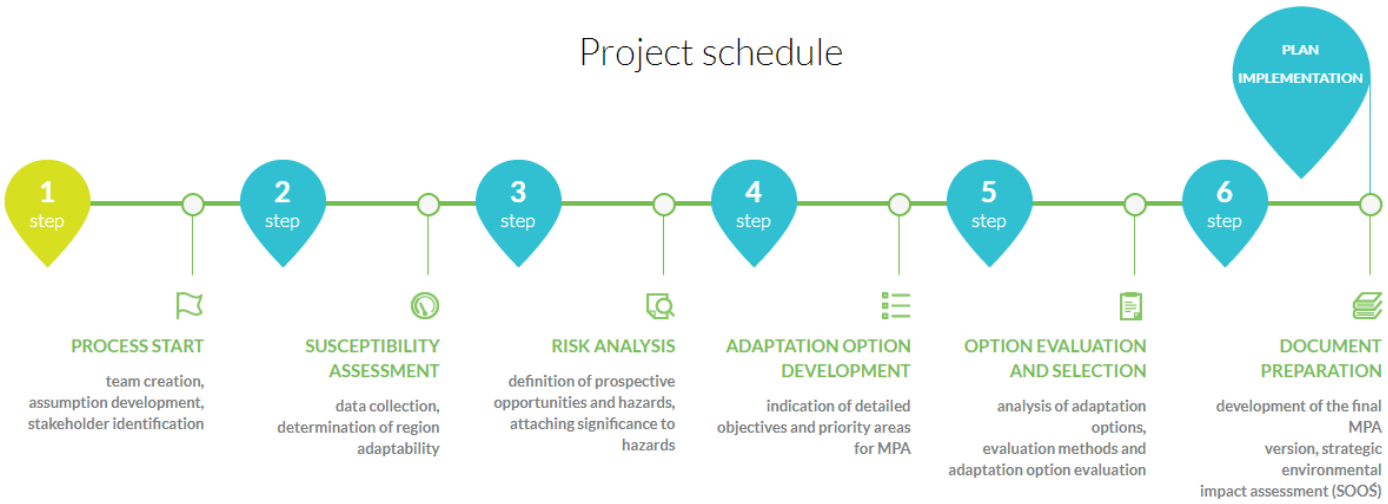


Illustration 6.2. Overview of project phases
Source: 44MPA, n.d.[c]

For step 2 and 3, a methodology was developed by Zdzisław Cichocki and his team, all from the Institute of Environmental Protection – National Research Institute. Prior to the project the methodology was tested in the city of Kalizs[3]. The national government preferred this methodology as it is concise and transparent for as well the national government as the municipalities (interview national consortium members).

As part of the 44MPA project the consortium team will analyse all the local policy documents of the cities. If they find contradictions to the Urban Adaptation Plan they will write an annotation on how it should be adjusted. This is new as Brouwer, Rayner & Huitema (2014) conclude that in the Polish context, policy makers generally do not undertake action to tackle contradictions in climate policy. This results in a low consistency in their climate policy which seriously hampers mainstreaming of climate change mitigation and adaptation This is acknowledged by the national consortium and therefore this step of document analysis is added. There has to be mentioned that it is purely an advisory annotation.

The final deliverable is in the form of a Urban Adaptation Plan, which has identified vulnerability of a city to climate change (steps 2 and 3) and proposed actions to act accordingly (steps 4 and 5). According to a consortium member, the strategy can be used to change local law. Moreover, it can be applied as input for public tenders to include more climate adaptation considerations. Lastly, financing for climate change related issues is a big challenge in Poland. This plan can be deployed to attract financial resources from national funds to run pilots. Moreover, according to respondents from the national consortium, there is a social co-benefit that through the workshops municipal officials will see the benefit of cooperation. Before there is little to no cooperation between municipal departments in Poland. This statement was affirmed by a municipal official in Poznan. There has to be mentioned that the Urban Adaptation Plan should be regarded as a proposal for climate adaptation action. It sets a direction for possible action.

The project has a total budget of EUR 7 million. Of this 85% is coming from the EU Cohesion fund and 15% from the Ministry of Environment. With a total of 77,6 bln Euro for the period 2014-2020, Poland is again the largest beneficiary of the Cohesion Policy (European Commission, 2014). According to the consortium team members, a municipality only has to invest time and people. There

[3] The experiences are written down in a paper: Cichocki, Z., Hajto, M., Romańczak, A., & Sadowski, M. (2016). SENSITIVITY TO CLIMATE CHANGE IN THE CITY OF KALISZ–CASE STUDY. *Inżynieria Ekologiczna*, *2016*(49): 8-24.

is also funding for follow-up project to stimulate implementation of the Urban Adaptation Plans. According to a researcher is the current national government not concerned with climate change. It is the previous government who started the project. Future EU funding are in danger if the project would be stopped, but there is not motivation in the national government for this project.

Urban Adaptation Plan, Poznan

As mentioned before the 44 cities are divided over the consortium members. Poznan is placed under the Institute of Environmental Protection – National Research Institute. Their team consists of three core members with occasional support from for instance GIS employees or communication. The municipal team consists of 12 representatives from different municipal departments and governmental organisations, such as Aquanet, responsible for water quality, water safety and water issues. The mayor directly appoints the team members. Their role is to actively participate in the workshops and deliver data and relevant documents to the consortium team for their assessments. As mentioned before, knowledge on climate change within the city is minimal. This affects the results as the assessment. Still Poznan has compared to other city quite a lot of data, cities in Poland generally do not keep record of climate change-related data. More recently, this problem has been recognised and in Poznan now rainwater and temperature will be recorded (as indicated interview with municipal official and consortium team members).

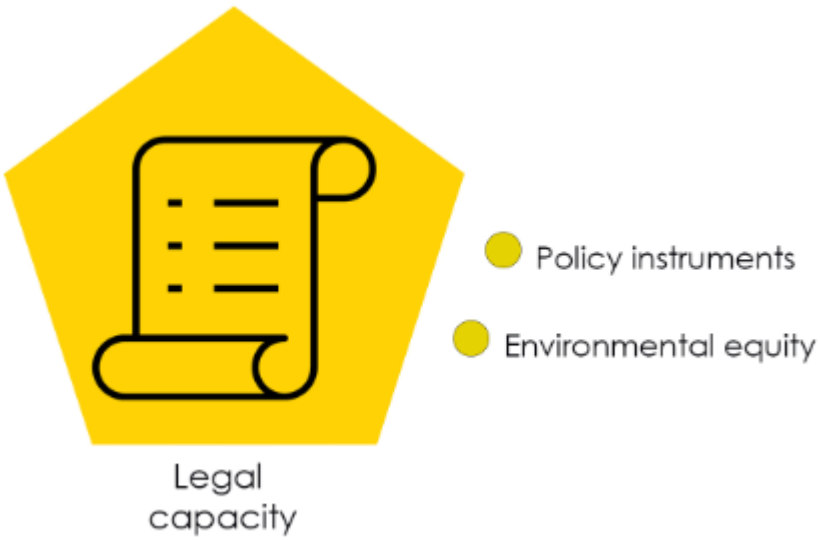
Next to the Urban Adaptation Plan, the city op Poznan is also working on a rainwater strategy. This process has started after the summer last year. The problem of increasing precipitation due to climate change has been recognised. As there is no experience with spatial adaptation, the city of Poznan organised a business trip to two German cities. This fieldwork was used as inspiration for climate adaptation action. As a respondent indicated, municipal officials are not aware of climate change impacts on urban areas or the municipality's responsibilities in adapting to this. He clearly underlines that first awareness has to be established through for example business trips or strategical projects as the Urban Adaptation Plan. Most of the municipal officials that work in the rainfall strategy are also involved with the Urban Adaptation Plan. The rainfall strategy has not been placed under a municipal department's responsibility. Rainfall strategy costs around 1,5/2 million Zloty which is 350717/467623 million euros (interview municipal official).

Chapter 7 Comparative analysis

Each case was deliberately chosen as they differ in the level of mainstreaming climate change adaptation into spatial planning. This allowed for maximum variation in conditions and criteria that determine the planning capacities to mainstreaming climate change adaptation. The following chapter compares the planning sectors of the three European cases on their planning capacity to mainstream climate change adaptation into spatial planning. It is a lateral comparison, executed to identify similarities and differences between planning capacities. To this end, the evaluation framework for planning capacities is applied (chapter 3).

In order to ensure a consistent comparison of all cases, the evaluation framework applied following a strict structure, i.e. per sub-capacity and its conditions. According to the sequence of the framework, the structure of this chapter is as follows: section 7.1 discusses the legal capacity, section 7.2 the institutional capacity, section 7.3 the social capacity, section 7.4 the resource capacity and, lastly, section 7.5 the learning capacity. Each section is divided in sub-sections addressing the conditions that are essential for the concerned planning capacity, as defined in the evaluation framework. After the five planning capacities have been discussed, chapter 8 'Conclusions and discussion' will elaborate on the implications of the similarities and differences between the cases in relation to the main research question.

7.1 Legal capacity



7.1.1 Policy instruments

Three criteria for policy instruments have been identified: presence of policy instruments, policy cohesion and statutory compliance.

Presence of policy instruments

The indicator used fort his criterion is (1) the existence of policies and regulations regarding climate change adaptation at a national, regional, municipal and project level.

Gothenburg has the most deliberate and structured policy efforts on a city and project level, whereas the Netherlands has the most on a national level. Poznan is the only city that will have an integral climate change adaptation plan, but currently has none policies that mention climate change adaptation.

On a higher government level, both Poland and the Netherlands have a National Adaptation Strategy (NAS). The Netherlands, however, has a considerably longer history of spatial adaptation planning. The first deliberate policy effort stems from 2007 (NAS). In Poland, the NAS from 2013 is one national policy instrument. Furthermore, in the Netherlands some of the programmes are accompanied by a big policy programme to facilitate implementation (Delta programme and Delta commissioner) and Polish respondents state that there were no national activities after the publication of the NAS2020. In the case of Gothenburg there is a frustration due to the lack of guidance from the national government; i.e. there is no national adaptation strategy and related actions. The County Administrative Board, the national government's regional representation, highlights that the lack of a national strategy brings their legitimacy into question.

In all of the three cases climate change adaptation action has been delegated by higher government levels to municipalities. In Gothenburg, climate change adaptation is protected and strengthened in the vision Rivercity (addressing rainfall and sea level rise), city's Comprehensive plan (annex on rainfall and sea level rise). Although Poznan will soon be the only case under investigation that will have an integral climate change adaptation strategy (Urban Adaptation Plan as part of the 44MPA project), it currently does not have any policy instruments that relate to climate change adaptation. There are, however, policy instruments that could be linked to climate adaptation (flooding strategy and the environmental programme). Currently, the city is working on a rainfall strategy where the increase in rainfall is related to climate change. In Utrecht, climate change adaptation is increasingly represented in policy instruments. Revised policy instruments from after 2015 do elaborate on climate change adaptation (Groenstructuurplan, plan Gemeentelijke Watertaken, kadernote Kwaliteit Openbare Ruimte).

Policy cohesion

Indicators used to measure the strength of policy cohesion are (1) the level of contradictions between policies and regulations on a national, regional, municipal and project level, and (2) the level of overlap between policies and regulations on a national, regional, municipal and project level

Policy cohesion in Merwedekanaalzone is strong on a national-local level, which is lacking in Gothenburg. Whereas in Frihamnen a strong policy cohesion between municipal policies is observed. Poznan does not mentioned climate change adaptation in any policies expect for the upcoming Urban Adaptation Plan.

As described in the case introduction of the 44MPA project, the consortium team will execute a document analysis on policies to identify potential policy contradictions. According to respondents from Poznan, municipal departments nowadays write policies independently, which is why policy contradictions are frequently occurring. The consortium team from the 44MPA project writes annotations, but the municipality decides if they change policies accordingly. The city of Utrecht is updating many policy documents and incorporate climate adaptation into it. This is in line with the target to have integrated climate change adaptation into planning policies by 2020, as formulated in the national Delta programme. Gothenburg lacks national guidance, so there cannot be spoken of policy cohesion between national-municipal level. On a city level, there is coherence between several policies. Different planning documents for Frihamnen gradually concretise climate adaptation solutions from strategy (vision Rivercity Gothenburg, 2012) towards concrete measures (Local Detailed Plan, 2016). Moreover, there are intermediate documents to ensure consistency in the climate adaptation targets that are gradually more refined in the documents. Moreover, to avoid opposing objectives across departments, the project team for Frihamnen started with a mandate to ensure consistency regarding climate change adaptation in the local detailed plan.

Statutory compliance

Indicators analysed are (1) the level of respect for climate change adaptation policies, objectives and regulations among stakeholders, and (2) the level of flexibility of climate change adaptation policies and regulations to adjust to possible future situations

Each case assigns different legal standard to policy documents, this is determined by the political context. In Poland legal basis is necessary to ensure action. In Merwedekanaalzone and Frihamnen, respondents found it more stimulating to work with covenant and mandates that all stakeholders sign. For all three cases it is too early to make a founded statement on the level of compliance.

Although policy integration is necessary for successful climate change adaptation, Poles are not willing enough to integrate and act on behalf of the common good. There is a possibility that legacy of the communist period is still present in people's values, culture and behaviour. (Sakowisz, 2017). This is reflected in the scepticism among respondents about the actual implementation of the Urban Adaptation Plan by the whole planning sector. When it lacks practical measures or legal basis, then there is a chance that it is not complied with. It is too early to tell if the Urban Adaptation Plan will be complied with, but there are negative expectations. For both Frihamnen and Merwedekanaalzone there can be said that there is uncertainty on the compliance at this point in the planning process. However, both the urban plan of Merwedekanaalzone as the local detailed plan of Frihamnen have been co-created with the stakeholders, resulting in a shared understanding of the development. There is respect for the agreement and choices have been made deliberatively, thus there is a more positive expectation with respect to compliance. However, it is also too early to tell as neither of the cases have started building.

7.1.2 Environmental equity

Two criteria for the condition environmental equity will be discussed: awareness of social vulnerability and redistribution mechanism to promote environmental equity.

Awareness of social vulnerability

Indicator used to describe the social vulnerability is (1) the extent of awareness on the relation of social vulnerability and environmental equity situations where social groups are disproportionality affected by climate change impacts.

It is increasingly being recognised that climate change impacts are unequally distributed over the city in Gothenburg and Utrecht. Based upon climate change knowledge, both cases deliberately draft policy to reduce the most vulnerable spots to climate change. There is, however, no linkage made with the vulnerability of certain social groups as elderly. As part of the national methodology to develop Urban Adaptation Plans, there will also be looked at data on vulnerable groups on elderly or lower social classes. However, not much data is available in Poznan.

Redistribution mechanisms to promote environmental equity

Indicators to analyse this criterion are (1) the extent of openness of data on climate change vulnerability of social groups and (2) the inclusion of redistribution mechanisms to address social vulnerability of certain social groups.

It is increasingly recognised that climate change data is essential for environmental equitable policy. Cities as Utrecht and Gothenburg are increasingly addressing climate change vulnerable locations and social groups. Gothenburg has made the data assessable for practitioners and citizens.

Geospatial information is increasingly being used to highlight vulnerable areas to climate change and outline spatial plans visually. Data on climate change in increasing in volume. Accordingly, all cities undertake actions to reduce vulnerability to rainfall. Poznan is now gathering rainfall data to address vulnerability. Though not related to climate change, the city has successfully addressed vulnerability to river flooding. In Gothenburg, the focus is also on flooding and rainwater. The city of Utrecht has a project running to restructure older neighbourhoods that are heavily affected during periods of excessive rainfall. So gradually, as the data increases, policy can address the vulnerable locations.

In terms of openness of data, Gothenburg is the forerunner on available climate change data of the cases under investigation. A website has been launched this year with detailed information on vulnerable areas to sea level rise and impact areas to excessive rainfall. The city of Utrecht does not have such data available. There are some national initiatives that have similar data online available, but not at a street level.

Table 7.1. Overview of legal capacity

Conditions/criteria	Frihamnen	Merwedekanaalzone	44MPA
Policy instruments			
Presence of policy instruments	Strong on a municipal level, but lacks policy instruments on other governmental levels	Strong on a national level; the city of Utrecht is developing more policy instruments	Currently not at municipal scale, there is national finance programme
Policy cohesion	Planning documents nicely overlap and there is overlap in public policy on climate adaptation; no national guidance, so no statements there	City of Utrecht has made effort to align policy documents more in terms of climate adaptation; strong alignment with national policies	Checking policy documents on contractions is part of the 44MPA project; but uncertain if it will be addressed by the municipality
Statutory compliance	Too early to tell, but positive expectations	Too early to tell, but positive expectations	Too early to tell, but negative expectations
Environmental equity			
Social vulnerability	Not of concern among practitioners in Frihamnen; no formal regulations on city level	Not of concern among practitioners in Merwedekanaalzone; no formal regulations on city level	Not recognised
Redistribution mechanisms	Is undertaking action based on climate change data; has accessible data	Is undertaking action based on climate change data; low accessibility of data	Are some examples of projects to reduce vulnerability. Rainfall strategy is in progress
Main similarities			
-Social vulnerability not formally recognised. -None of the cases had sufficient policy instruments on every level. -Each project was in too early in the project to tell if climate adaptation is complied with.			
Main differences			
-Number of projects to address social vulnerability is gradually developing, not on an advanced level yet. Poznan will have rainwater data soon. -Even though Gothenburg and Utrecht were graded with as moderate on presence of policy instruments, they have different contexts on this criterion; in Gothenburg policy instruments are present on a municipal level and in Utrecht mostly on a national level.			

7.2 Institutional capacity

7.2.1 Organisational structure

Support from the leadership

The indicator analysed are: (1) the level of support from city council for adaptation planning, and (2) the level of support from public managers within a planning sector for adaptation planning.

The project Frihamnen has the highest support from city council and public managers for spatial and adaptation planning because the municipality is landowner. For Merwedekanaalzone and the Urban Adaptation Plan there is support for the project due to the size and political value, but not for the adaptation aspects of it.

For each of the cases there can be said that there is a high level of support for the projects. Due to the size of all the projects, the advancement of the projects is of political concern. For each of the projects, city council made some decisions for which they can be hold responsible by citizens. Therefore, each case is placed under the direct responsibility of a city councillor. Even though in Poznan city council has not set up the project themselves, the mayor formed the municipal team. He supports the project and additionally want to formulate a rainwater strategy. Within Gothenburg there are extra drivers for the involvement of city councillors, namely that the city is landowner and the first phases has to be finished by 2021, as it is Gothenburg's 400th anniversary. As mentioned before, as landowner, the City of Gothenburg uses Frihamnen as an experimental ground under their responsibility.

There are some differences in the level of support for climate adaptation specifically. In Gothenburg, city council gave the mandate to research climate change impacts on the city and how to prepare for it. City council is not yet ready for large adaptation measures as storm flood barriers, but the mandate is larger compared to the other cases. As mentioned earlier, city council in Utrecht rather speak of spatial adaptation because of the political sensitivity of climate adaptation. Therefore, city councillors from the city of Utrecht focus on mitigation, whilst adaptation is being waited for until next elections for city council. Similarly, in Poznan, climate adaptation is not under the responsibility of any city councillor, nor have they mentioned it publically. However, the current mayor who was installed in 2014 is relatively environmental friendly. Since mayors hold a lot of power in Poland, this could mean a change towards climate change awareness within city council.

From the 44 participating cities, Poznan's city council is relative open and active in participation, and the mayor has initiated the rainfall strategy.

Although managers in Gothenburg and Utrecht support climate adaptation in spatial processes, they do not actively promote it. They are rather reactive to the actions of civil servants. Due to the lack of an official assignment, climate adaptation is now left to the arbitrariness of individuals or team managers within the planning sector. In Poznan there was at time of the interviews one active manager who conveys climate adaptation. With this advocating the city has initiated the rainfall strategy.

Organisation of spatial and adaptation planning

The following indicators are used: (1) the level of inter-sectoral cooperation to enhance long-term adaptation planning, and (2) the extent to which meetings have been stipulated for the enhancement of inter-sectoral cooperation on spatial and adaptation planning.

Fihamnen has the highest level of inter-sectoral cooperation. The city of Utrecht has reformed their public administration to foster inter-sectoral cooperation. In Poznan, the Urban Adaptation Plan aims to stimulate more inter-sectoral cooperation, which is not common in Polish cities.

The city of Utrecht recently reorganised the public administration towards a system of 'guilds'. With these 'guilds', the city aims to put the content of a project at the centre, with programme managers that can form coalitions of municipal officials from different sectors. Even though it is too early after the reorganisation to make statements on the functioning of it, employees do appreciate that inter-sectoral working is enhanced and see the potential of the new 'guilds' system. Similarly, within the city of Gothenburg there is the Planning and Building Committee that meets four times a year to discuss development of Gothenburg with representatives from different municipal departments. Within the project Merwedekanaalzone the project is still structured by sectors. Six external consultants with their own expertise are hired to advise on one aspect of the urban development. They meet every 2 weeks to exchange ideas. Municipal officials are included on occasion to advise on one aspect of the plan by one of the external consultants. However, Gothenburg organised the project of Frihamnen differently, that is workshops with representatives from all relevant municipal departments and other urban actors. Successfully, as they won a price for their planning process. The core team of Frihamnen meets every 2/3 weeks and the consortium joins every fourth meeting. In Poznan only three workshops for the 44MPA per city are organised.

Coordination

Indicators for the criterion coordination are (1) the level of vertical coordination with other governmental levels regarding spatial and adaptation planning, and (2) the level of horizontal coordination with other local authorities regarding spatial and adaptation planning.

The city of Utrecht has strong and supportive vertical coordination complemented with horizontal coordination. The 44MPA is a national government led project, thus there is strong vertical coordination. This is lacking in Gothenburg, just as relevant horizontal coordination on climate adaptation.

The city of Utrecht shows most vertical and horizontal coordination with other governmental levels. Climate adaptation is regarded as a matter that should locally be implemented, but on a bigger scale should be 'learned'. This can be achieved by, for instance, sharing best practices, financial simulation programmes and setting ambitions. Therefore the national government is engaged through the Delta Commissioner and activates local authorities to undertake climate adaptation action. Moreover, a

cooperation of the city of Utrecht with the Province of Utrecht has resulted in a list of design principles for a climate adaptive Merwedekanaalzone, as part of their innovation programme 'inner-city development'. Poznan also has a strong vertical coordination for this 44MPA project, but this is due to the fact that it is a project by the Ministry of Environment. Other governmental levels are not involved. The city of Poznan has no cooperation with other governmental levels or local authorities on the theme climate adaptation. Municipal officials from Gothenburg expressed a frustration of the lack of vertical coordination on the topic of climate adaptation. It is purely knowledge generation and dissemination, but Gothenburg exceeds their knowledge base with own knowledge generation. The regional authority (Country Administrative Board) has a checking role to ensure safety for citizens regarding water levels, but this is testing role rather than cooperation. Locally, the city of Gothenburg participate in the Regional Association of Local Authorities on planning issues to streamline urban development in the whole region. Sustainability is the overarching designation within this association, but climate adaptation is not a theme itself. The city of Utrecht also has the best horizontal coordination as they participate in the Coalition Spatial Adaptation where knowledge and best practices are being shared regarding climate adaptation, and the partnership U10 is a cooperation for spatial planning issues.

7.2.2 Accountability

Transparency

The indictors used to measure the transparency are (1) the extent of openness of data and documents regarding spatial and adaptation planning and (2) the extent to which formal governmental policies enhance openness of date regarding spatial and adaptation planning.

In both Frihamnen and Merwedekanaalzone transparency on planning processes is established through public consultation on planning documents. This is low in Poland.

Gothenburg is most advanced in terms of transparency on their spatial and adaptation planning data. Residents can only access the spatial planning plans for the whole city digitally (Minstad.goteborg.se) in a virtual setting. Moreover, they have been given the option to leave location specific notes or issues. As well Frihamnen as Merwedekanaalzone have multiple planning documents online. Some of them are mandatory (local detailed plan and Environment and Planning Vision, respectively) and some are additional material on the planning process (workshop results and development ambition Merwedekanaalzone, respectively). This results in a high level of transparency on the planning process. Especially compared to Poznan, where planning documents are rarely publically accessible. The Open Data Barometer for natural environment statistics confirms this observation with their scores: Sweden 95/100; Netherlands 75/100; Poland 5/100[4]. In fact, in Poland, open government data is driven by legal compliance, rather than serving society of the public administration.[5]

Clear division of responsibilities

The indicators to assess this criterion are (1) the extent to which responsibilities for climate adaptation have been formalised, and (2) the level of familiarisation to these responsibilities among stakeholders.

[4] See website Open Data Barometer: http://opendatabarometer.org/?_year=2016&indicator=ODB
[5] OECD report on Government Data; OECD(2015). *Poland,unlocking the value of government data*. OECD: Paris.

None of the cases has formally placed climate adaptation under the responsibility of an organisation, municipal department or individual.

In none of the cases responsibilities for climate change adaptation have clearly been stipulated and placed under a department's responsibility. Both Gothenburg and Utrecht struggle with the fact that they encounter unexplored terrain of dealing with rainwater in the public realm; i.e. rainwater should first be stored and processed within the area and not directly drained it into the sewage system. Thereby the responsibility for the problem at hand had widened to more departments. Capturing rainwater on the surface means that the traffic department, park administration and water departments are affected.

As explained in the case introduction of Friahmnen, five municipal department are involved with designing the adaptation options. What their responsibility exactly entails remains unclear. "Everybody and nobody has climate change adaptation in their tasks". The designing phase is used to determine who will be responsible for the adaptation solutions once implemented. At this time, climate adaptation in Utrecht is placed under the responsibility of one civil servant, but this is not formalised. With the new approach by the city of Utrecht of 'guilds' is not making the question regarding responsibility for climate adaptation easier, as the new programme manager climate adaptation it is still not formalised with a mandate nor resources to act. In Poznan, the topic of climate change is new and the municipality is exploring what adaptation entails and which municipal representatives or departments this concerns. Currently, responsibilities for climate change-related impacts as droughts or water damage induced by excessive rainfall are now scattered over municipal departments. For all three cases, it is unclear who is responsible for maintenance work of the envisioned climate adaptation measures.

Person/group to be held accountable

The used indicator is (1) the presence of the person or group that can be held accountable for climate change adaptation.

Accountability regarding climate change adaptation is found ambiguous. In line with the previous criterion, lacking a clearly defined responsibilities for climate adaptation results in low accountability in terms of a person or group that can be held accountable. In each case there are some nuances to make however.

Gothenburg is the only municipality which has placed climate change adaptation under the responsibility of the Planning and Building Committee. However, this is a network of civil servants from different departments, a detached committee with no clear mandate or role. It can therefore not be hold accountable. The fact that the city of Gothenburg own all of the ground in Frihamnen, opposite of being one of the six property developers as in Merwedekanaal, makes the City Planning Department the accountable entity for the spatial and adaptation planning process. However, the accountability remains ambiguous as nobody within the municipal department or city council is directly responsible. The consortium of developers in Merwedekanaalzone have signed a memorandum for cooperation and climate adaptation is recognised by them in their plans. However, this memorandum has no legal basis, nor public function. If somebody would decide to draw back and start developing themselves, they easily could. The municipality of Utrecht is involved in Merwedekanaalzone with both a private role (as landowner) and public role (responsible for public space and testing if development targets are in line with the city-wide development perspective). They are responsible for climate change related issues when the area is completed and therefore they oversee that it is incorporated properly. However, they lack a legal basis to incorporate climate

adaptation measure, it is based on voluntary cooperation. Climate change adaptation is not yet recognised by the public administration of Poznan and therefore not officially placed under somebody's responsibility. As in Poland mayors are directly chosen, they be hold accountable.

7.2.3 Embeddedness of climate change adaptation in public policy

Discourse embeddedness in public policy

The indicators analysed are (1) the occurrence of climate adaptation and adaptation in policy documents and lingual usage by respondents, and (2) the sense of urgency among stakeholders for climate change in terms of feeling the necessity to adapt.

In Frihamnen, climate change adaptation is well embedded, even to an extent that water has been framed as an asset. In Merwedekanaalzone, climate change adaptation is embedded in the language of respondents but not yet comprehensibly captured in policy documents. Climate change adaptation is a new discourse in Poznan and imposed top-down.

In Frihamnen, there is a necessity to elevate the ground in order to build safely against rising sea level. Besides, they experiment with capturing rainwater at the ssurface. Therefore, water has been framed as an asset in some policy documents. For Merwedekanaalzone and the 44MPA project there are no urgency to act immediately, but rather preparing for future impacts. Although practitioners within Merwedekanaalzone acknowledge the need for climate change adaptation, discourse embeddedness of climate change adaptation in policy documents is much poorer in Utrecht. This has to do with the current political preferences of the city council as they do not support climate change adaptation. Therefore, the policy advisory purposely awaits the next elections to advocate for more embeddedness of climate change adaptation in public policy. Currently, climate change adaptation is fitted under the 'Healthy Urban Living' approach of the city of Utrecht. In Poznan climate change adaptation is not embedded in public policy. Not mentioned once. As mentioned in the introduction, this is partly due to their focus on economic growth and establishing a viable and competing business location. When looking closely at several spatial projects, it is found that some project address climate change impacts (e.g. Malta lake that is being used for water retention), but are not framed as climate adaptation measures.

Ambitious and realistic goals

Two indicators are used: (1) the extent to which formulated targets address new challenges rather than the conventional ones, and (2) the level of cohesion between long-term and short/mid-term targets.

For each case it can be said that the targets for climate change adaptation are rather ambitious within the local context. They do address new challenges and aim for novel solutions. Practitioners within Poznan are somewhat sceptical about actual usability and implementation of the Urban Adaptation Plan. On the contrary, practitioners within Frihamnen and Merwedekanaalzone are content with the formulated climate change adaptation goals. Although precise implementation remains uncertain, there goals are found ambitious.

Compared to the prior situation, developing a Urban Adaptation Plan is quite ambitious. The topic is new and hardly understood by most civil servants in Poznan. The project execution is also realistic because of the clear delineation. Due the size of the project (44 cities) the project has very clear defined goals to ensure consistency among the cases. However, there is a fear that the end product

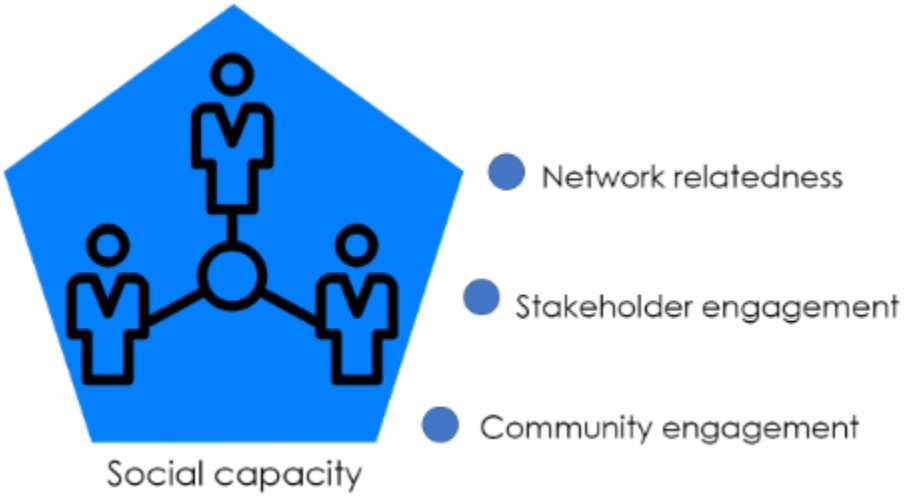
will be too general and simple, with not enough connection with the municipality. After all, it is rather an icon project for the Ministry of Environment rather than the city of Poznan.

For as well Frihamnen as Merwedekanaalzone, the current ambitions and goals transcends earlier urban development goals. This accounts for multiple contemporary challenges as becoming energy neutral, optimising waste management and promoting new forms of mobility. Specifically for climate change adaptations, both cases are experimenting with new ways of treating rainwater. The city of Gothenburg is further in this respect, as they have specified the ambition to threat rainwater at the surface already at the invitation to property developers by developing a manifest with the major ambitions for development. Cooperatively, the ambitions has been designed through a series of workshops into an implementable solution. To what extent developers eventually commit to the manifest is hard to predict. Therefore, the project leader aims to revise the manifest regularly in the belief that it ensures continuity of the strategical goals in time. Utrecht has a similar product, the urban plan, which is also co-created in working sessions. In both cases, the co-creation created a shared understanding of the public space, which increased the belief of respondents that it will be implemented.

Table 7.2. Overview of institutional capacity

Conditions/criteria	Frihamnen	Merwedekanaalzone	44MPA
Organisational structure			
Support from the leadership	High level of support due to size of projects; also mandate given by city council	High level of support for spatial planning due to size of projects, support for adaptation is not high	Project was imposed, no active support
Organization of spatial and adaptation planning	Strong inter-sectoral cooperation; first in workshops, later in 2/3 weekly meetings	Sectoral organised; 2 weekly meetings between disciplines	Project crosses municipal disciplines, but Poznan has sectoral set up; only three workshops
Coordination	Weak national guidance on climate adaptation; not working with municipalities on climate adaptation	Strong national guidance on local adaptation; also included in regional collaborations on spatial and adaptation planning	Strictly coordinated from national government (top-down), which might affect later implementation
Accountability			
Transparency	Open and easy accessible data online on spatial planning; deliver more than law prescribes	Planning documents are made public as law prescribes. Some additional documents	No open date on spatial planning processes, not climate change impacts
Clear division of responsibilities	Climate adaptation has not been placed within someone's formal tasks	Climate adaptation has recently been assigned someone's formal tasks within the municipality; not within Merwedekanaalzone though	Not formally assigned to someone's tasks
Person/group to be held accountable	Ambiguous accountability; maintenance is unsure, being sorted out	Not for climate adaptation specifically	Not for climate adaptation specifically
Embeddedness of climate change adaptation			
Discourse embeddedness	Climate adaptation is a reoccurring discourse in public policy	Climate adaptation is a reoccurring discourse in public policy, but rather random. Importance is increasing	Not yet; unsure if adaptation strategy will be adapted in other policies are discourse
Formulated goals and targets	Novel and ambitious within project and municipalities	Novel and ambitious within project, on city level targets/goals remain vaguely described	Not yet, new urban adaptation and rainfall strategy will policy with climate adaptation target/goals
Main similarities			
-Climate change adaptation is in none of the cases placed under someone's responsibility -It is recognised that climate adaptation needs to be embedded as discourse (also in Poznan, but unsure if this will be properly adopted in other policy documents).			
Main differences			
-Transparency on data differs greatly. -Each case has different levels of coordination. In the Netherlands a well structure for vertical and horizontal coordination is established, which is lacking in Gothenburg. -Support from the leadership for climate adaptation is not present in each case. -Inter-sectoral cooperation is not a given in each case.			

7.3 Social capacity



7.3.1 Network relatedness

Active participation

The indicators analysed to measure active participation are (1) the presence of relevant networks that are in place for spatial and adaptation planning, (2) the extent to which stakeholders actively participate in networks on spatial and adaptation planning, and (3) the utilisation of network participation in terms of sharing methods, best practices and knowledge.

The city of Utrecht participates most actively in national and international networks that are beneficial for climate adaptation action. This is beneficial for the project Merwedekanaalzone. Poznan has the 44MPA project as relevant network. No relatedness to any relevant networks was found within Gothenburg.

The city of Utrecht is engaged in some collaborations with other municipalities (U10 for spatial planning and the Coalition Spatial Adaptation for climate adaptation). Moreover, the national research programme Knowledge for Climate was beneficial for the city as the University Utrecht participated actively on the topic urban governance issues of climate adaptation. Moreover, the city of Utrecht benefits from the Smart City District project, part of the EU body Climate-KIC. The redevelopment of the train station is part of this project, benefitting from external knowledge and financial input from this network. Climate adaptation is also part of the project and delivers useful information for Merwedekanaalzone too.

The advantage for the city of Poznan is that the 44MPA project itself is a relevant network with relevant climate adaptation knowledge and relations. The disadvantage for Gothenburg is that within the country there are no relevant networks which they can extract knowledge from regarding climate adaptation. They exceed regional and national climate adaptation goals and practices. The city did host the 'Embrace the Water' conference in June 2017, because of its approach to cope with water.

7.3.2 Stakeholder engagement

Stakeholder inclusion in the decision-making process

The analysed indicators are: (1) the extent to which all relevant stakeholders are timely informed on spatial and adaptation planning, and (2) the sense of ownership on spatial and adaptation planning choices among stakeholders.

In Frihamnen the highest sense of ownership was found because practitioners co-create the solution. Decision-making is scattered over several landowners in Merwedekanaalzone. In Poznan, decision-makers are only three times informed by the 44MPA project group.

Out of the case introductions, big differences in stakeholder inclusion were found in terms of the composition of the decision-making team. In Gothenburg and Utrecht, the difference can be explained by the landownership. This is in Gothenburg fully the municipality and in Merwedekanaalzone a group of six landowners, including the municipality. In Gothenburg, several municipal departments and property developers co-create the adaptation measures. All stakeholders have a formal say in the decision-making process. The municipality of Utrecht is timely informed on decisions, but has not formal say in in the planning of climate adaptation. Rather, the collective of landowners do and they have outsource adaptation planning to one bureau. There is consequently no sense of ownership on the adaptation solutions among stakeholders. The municipality's strategy therefore is to gradually insert their ideas into the process, benefitting that they have a public role for the public space and a private role as landowner. In Gothenburg respondents from municipal departments have a stronger sense of ownership. Wihtin the 44MPA project, decision-making is at the municipal team. It was indicated that it is hard to take adequate decisions as there are only three formal information moments. Moreover, it is hard to activate stakeholders in Poland for collaborative projects that go beyond the traditional sectoral approach.

Well balanced power-relations

The used indicators for this criterion are: (1) the extent of equal power relations among stakeholders in spatial and adaptation planning, (2) the sense of trust among stakeholders on other stakeholder's contribution to the planning and adaptation process, and (3) the presence of tactics for dealing with (dis)proportionate levels of power between stakeholders,

In Frihamnen and Merwedekanaalzone there is an equal say between the decision-makers. Although this also accounts for the municipal team of Poznan within the 44MPA project, there is not a lot of trusts among practitioners and the municipal team is not actively involved.

As the municipality of Utrecht lacks formal regulation on climate adaptation, the decision-making power lays with the landowners, just as in Gothenburg. Contrary to Gothenburg, the municipality is one of the 6 landowners and does not have final say. All landowners do have an equal say in the decision-making process. In Gothenburg there is strived for 'equal pencil' meaning that every practitioners has an equal contribution to the designing process, established through a system with first workshops to establish a shared understanding and then regular checks and balances on the adaptation planning between different municipal department that contribute. There has been one incident that due to time constraints there was a moment where the City Planning Authority took over the planning process.

The crux in Utrecht is that property developers are not obliges to follow the urban plan that recently has been published. Decisions only become binding in construction/zoning plans. Obviously,

they commit themselves to it and have benefits from following the decisions made in this process, but things might change per developer in time. Therefore, the municipality strives to form a public-private partnership after the completion of the urban plan. In Gothenburg, more consistency is naturally paired with this as the municipality is landowner. Changes can still occur when a crisis hits, for instance, but there is more control on the process. Even though all members from Poznan's municipal team have an equal say in the decision-making of the Urban Adaptation Strategy, it is the only case where there is not a lot of trust among member of the municipal team. This can be explained by their long-standing history of sectoral work. There is no experience with inter-sectoral work. The 44MPA project is regarded by some practitioners as a first attempt to break this.

7.3.3 Community engagement

Informing community

The applied indicator is (1) the existence of communication tools to inform the community on spatial and adaptation planning. These are more proactively actions that can be undertaken as opposed to engage community rather than transparency on spatial and adaptation planning documents.

Both in Frihamnen and in Merwedekanaalzone the community is actively being activated to be part of the urban development. This opposed to Poznan where no activities are present to inform or engage the community.

Community engagement is framed as an important feuture of the stpatial and adaptation planning within Friahamnen and Merwedekanaalzone. For the urban development of the old harbour area in Gothenburg, the municipal development company Älvstranden has opened an information centre named Älvrummet in 2008. Though smaller, in the city hall of Utrecht there is displayed a model of Merwedekanaalzone. Additionally, in both cases there are initiatives to engage community through meetings. The community is furthermore engaged to participate in theme discussions, called soup meetings, in Älvrummet. The period prior to building real estate, the area Frihamnen is home to Jubileumsparken, an initiative to have 'city life' in the area before it is finished. Also after completion the initiative will continue as a meeting place by and for everyone. As mentioned in the case introduction, in Utrecht there is an similar project 'Creating the city together' where also theme discussion with citizens are organised. An appealing difference, however, is that the community is more engaged with the development of Merwedekanaalzone than with Frihamnen. As Frihamenn was a closed off harbour area citizens do not yet have a bond with the area. That is why Jubleamsparken was started. There was already much more activity in Merwedekanaalzone that attracted some citizens. Furthermore, civil organisation MeerMerwede was active to activate distinctive community features that were already present in Merwedekanaalzone and represented them towards the landowners. In Poznan there are no such initiatives. The Urban Adaptation Plan will have to be communicated to the community. At this point it is unsure how it will be received by the community as there is no awareness nor urgency for climate adaptation.

Community inclusion in the decision-making process

Two indicators are analysed for this criterion: (1) the extent to which the community has a 'formal' voice in the spatial and adaptation planning process, and (2) the existence of formal governmental policies or regulations to promote community initiatives.

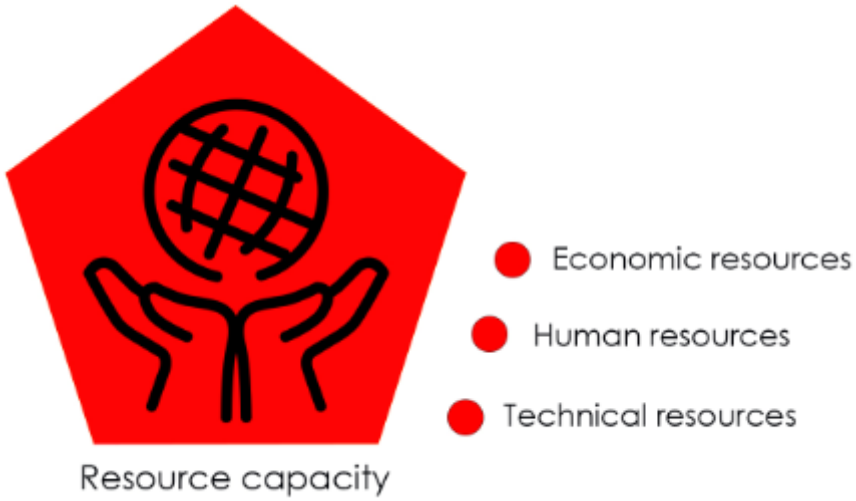
In Sweden and the Netherlands, public consultations on planning documents are enforced by law. Therefore these cases are scored better on this criterion than Poznan, as this is not mandatory in Poland, nor voluntarily offered.

The national government of Sweden has enforced two formal public consultation rounds on spatial plans by law. The first public consultation has to be answered to submitter on how they think they have covered the comments and the second one is to take knowledge of the comments, replying is not mandatory. This is the community's formal voice next to the soup meetings to inform the community. The latter are used to gain insights in the community's wishes and incorporate them in spatial plans before it has to go through public consultation rounds. This public consultation is also the driver for community meetings in Utrecht. It moreover establishes legitimacy for decisions. In Utrecht, citizens can respond to the urban plan and in a later stage the construction/zoning plans, which are legally binding. In contrast, public consultation in not mandatory by law in Poland, yet advised by the municipality of Poznan to include public consultations. Unsure if the Urban Adaptation Plan will go through public consultation before it will be adopted by city council.

Table 7.3. Overview of social capacity

Conditions/criteria	Frihamnen	Merwedekanaalzone	44MPA
Network relatedness			
Active participation	Nationally no options for relevant networks, thus occasionally participate in conferences	Participates in some national networks that are relevant for climate adaptation, not very active participation though	The 44MPA project is relevant, other than that no relatedness to any climate adaptation related network
Stakeholder engagement			
Stakeholder participation in decision-making	Stakeholders cooperatively design adaptation solutions	Designing is done by one external landscape bureau; all stakeholders are often and timely informed	Hard to activate stakeholders in Polish context; Poznan is doing relatively good
Well-balanced power relations	Strive for equal pencil and is proven by the many checks and balances	Property developers make the decisions, among these there are well-balanced power relations	Members of municipal team have equal say, but no trust among practitioners. Project first attempt to establish this
Community engagement			
Informing the community	Have community meetings; community not too engaged, have programme to activate more	Host information evenings about Merwedekanaal; lot of data accessible online	Neither is there information about the project for the community, nor about climate change in general
Community participation in decision-making	Two official feedback moments and programme to uptake community initiatives	Several formal moments for community feedback;	Not included
Main similarities			
-Sweden and the Netherlands both have community participation in spatial projects enforced by law. Therefore, high score compared to Poland where this is not common. -Within each project equal power relations are strived for, only addressed differently in practice.			
Main differences			
-In Utrecht community is far more engaged with the project development and attend information meetings, whereas the community cannot relate to Frihamnen yet as it has been a cut-off harbour area.			

7.4 Resource capacity



7.4.1 Economic resources

Affordability

Affordability is measured by the indicator (1) the availability of adequate internal and external financial resources for adaptation planning.

At the time of the research there are sufficient financial resources to finance the proposed adaptation plans across all cases. However, in Frihamnen and Merwedekanaalzone there have not been made decision on the finances yet.

For the completion of the project only Poznan at this point has the required financial resources covered. As mentioned in the case introduction, the project is funded by the national government with support from the European Union. However, this is funding for the formation of urban adaptation plans. For implementation or the formulated actions is unsure. For both Gothenburg as Utrecht there is a budget for the public space where all landowners contribute to, based on their share of the development. As both cases have a house shortage and the development areas are highly valuable due to the central location, it is assumed that sufficient revenue will be generated to cover the planned adaptation measures. Due to the high density, the municipality of Utrecht asks a higher financial contribution to design the public space than usually. It has turned into a marketable feature. There must be mentioned that for as well Frihamnen as Merwedekanaalzone the discussion about finances still has to take place, thus some uncertainty on the eventual affordability of adaptation measures are to be taken into account.

Willingness to pay

Two indicators are used: (1) the extent to which stakeholders are willing to pay for adaptation measures in terms of cost benefit considerations and perception of local climate change impacts, and (2) the extent to which co-benefits of adaptation have been identified to enhance willingness to pay.

In the cases Frihamnen and Merwedekanaalzone there is a willingness to pay for adaptation measures as practitioners are able to see the necessity to adapt and highlight co-benefits of adaptation measures. In Poznan this is considerably lower due to a sceptical and negative the attitude of municipal officials in Polish cities towards climate change. However, the city of Poznan is

more willing to pay because they also develop a rainfall strategy with accompanying investment plan. The rainfall strategy will mentioned climate change as a cause of the increasing precipitation.

Each case has underwent some climate change impacts; sea water flooding in Gothenburg, pluvial flooding in Utrecht and droughts periods in Poznan. It has to be mentioned that each case has a focus on one of the climate change impacts. This has to do with localities as the high tides in Gothenburg, the old sewage system in Utrecht and extreme heat periods in Poznan. At the same time, none of the cases has to endure a severe natural hazard with big societal impacts. A commonly heard argument that practitioners are not willing to take big investments in larger adaptation measures. On this point there are also big differences between practitioners in the planning sector. Property developers see the urgency to protect the area against sea level rise and increasing precipitation. They then prefer measures within the area. Storm flood barriers at the bay, consequently, are not in favour of property developers. Business cases with a return period of 20 years are not favourable for property developers. Similar observations were made in Utrecht were adaptation options are regarded to Merwedekanaalzone only. Climate change related issues is not something Polish cities want to pay for, as it is assumed that it poses serious consequences for the economy. This also accounts for Poznan at this point, which is why the national consortium of 44MPA addressed the co-benefits of adaptation. The 44MPA project therefore has a wide perspective on benefits in their methodology, including the effect on themes as public health, access to green space and air quality. Moreover, for both Frihamnen and Merwedekanaalzone adaptation measures were linked to social interaction in the neighbourhood. No translation was made on how this effects themes as public health and air quality directly.

Financial continuation

The following two indicators are used: (1) the presence of financial resources that secure long-term adaptation planning, and (2) the existence of formal policies to attract financing and to ensure that money is well spent.

None of the cases has reserved resources for long-term climate change adaptation investments.

Of the thee cases, Gothenburg is most advanced with long-term thinking for climate change adaptation. Within the City Planning Authority a team can submit possible research areas concerning climate change adaptation as the city council posed the question to what extent the city is vulnerable for climate change. They also participated in the Mistra Urban Futures project to combine the spatial planning goals with a research targets, which ensured extra financing. In Merwedekanaalzone, no money is reserved for long term planning and maintenance of adaptation by neither property developers nor the municipality. As a follow up of the 44MPA project, there will be funding to apply for by municipalities. The Urban Adaptation Plans should be employed to apply for funding. The budget of these investments is unknown and therefore no substantive statements can be made on the financial continuation of the project. On a city level, however, there is no funding reserved for climate change adaptation.

7.4.2 Human resources

Social acceptance

For the criterion social acceptance two indicators are used: (1) the level of motivation of stakeholders to realise, support and promote adaptation planning, and (2) the level of belief of stakeholders on the realisability and effectiveness of adaptation measures.

In Frihamnen and Merwedekanaalzone there is a motivation and belief in climate adaptation among practitioners, while in in the municipal team of the Urban Adaptation Plan motivation for climate adaptation is still low.

In both the project as within the public administration of the Gothenburg and Utrecht, Gothenburg shows the highest motivation and belief in climate change adaptation. In each of the three cases there is a motivation to make climate change adaptation successful. However, by incorporating stakeholders (both municipal officials and property developers) in the design process of the climate change adaptation ambitions, there is a shared understanding of the desired future situation in Frihamnen. Although in Merwedekanaalzone and the Urban Adaptation Plan for Poznan stakeholders are also included in the process, this is at a more abstract level and there is a lower detailed understanding of the climate change adaptation situation.

The high motivation and belief in Gothenburg can be ascribed to the land allocation procedure for the developed of Frihamnen. Prior to the land allocation, the municipality of Gothenburg has communicated that climate adaptation will be a main concern for the development of Frihamnen. This raised motivation and belief that the measures will be implemented. Moreover, both municipal officials as property developers were involved from the start. Therefore, they describe a feeling of motivation. This opposed to Merwedekanaalzone and the municipal team of the Urban Adaptation Plan in Poznan, were the planning sector is motivated to developed a climate adaptive area, but developing adaptation measure is outsourced to the landscape bureau OKRA for Merwedekanaalzone and a national consortium in Poznan. Of these, the municipal team of Poznan only meets three times with project team from the national government. In both cases this results in an divergent perception of the realisability and effectiveness of the adaptation measures among all stakeholders. The difference is that within Merwedekanaalzone the collective of owners deliberately chose the work with one landscape bureau whereas the project in Poland is regarded as a first step to raise awareness for climate adaptation among municipal officials.

Expertise

Indicators used to measure the criterion are (1) the presence of required skill set for adaptation planning, (2) the ability to include external expertise/knowledge resources.

It is acknowledged that a certain skill set and know-how is required for climate adaptation and proper actions are taken to ensure or maintain certain level of expertise across the cases.

Within none of the cases the required skills for adaptation planning were initially in-house. Each case dealt differently with this. Gothenburg opened land-allocation for property developers. They could safeguard high level of quality as they had 70+ applications. Additionally, some consultants were hired because they acknowledge that this project poses new challenges for the municipality in terms of density and the location. In Utrecht the land owners all have their own experiences with climate adaptation, based on examples they know from previous projects, but a landscape architect was hired to specifically design the climate adaptation solutions. The municipality is gradually expanding

its expertise through conducting research and cooperating with the Province or other parties. Within Poznan there is sectoral experience on water retention and green structures, but no integral expertise on climate adaptation. Next to the development of an Urban Adaptation Plans as part of the 44MPa project, there are no municipal or national knowledge institutes for climate change adaptation, opposed to Sweden and the Netherlands. The national consortium has to fulfil this tasks for now.

Human manpower

For the criterion human manpower the indictor (1) The presence of sufficient human manpower with adaptation planning was used.

There is sufficient human manpower involved in all of the three projects for the planning of adaptation measures.

Within each case there is enough human manpower to deliver the requested climate adaptation solutions. Of the cases, the city of Gothenburg has employed the most human manpower to develop adaptation measures in Frihamnen. However, they operate under great time pressure and the planning process is sometimes uncluttered in terms of uncertainty who of which department to check the adaptation measures from their department's perspective. It has led to the situation that the City Planning Department took over control when a deadline approached and excluded other municipal departments and stakeholders to smoothen the process. In Merwedekanaalzone, this has been outsourced to one bureau to design the measures with occasional meetings with experts from the municipalities. It is a different approach compared to Frihamnen, but it does deliver what is expected in terms of climate adaptation for Merwedekanaalzone. For the 44MPA project in Poland there is sufficient manpower is present to deliver an Urban Adaptation Plan for Poznan. The municipal team had to provide the consortium with data. Officials from the municipal team have a positive and active attitude towards the project, which smoothened gathering data and interpreting results.

7.4.3 Technical resources

Variety of solutions

The indicators applied are (1) the existence of a variety of adaptation solutions in planning processes and (2) the extent to which formal governmental policies and informal social patterns recognise the need and foster a variety of solutions.

Within each case there is a variety of solutions for adaptation planning and there are governmental policies that simulate exploring different adaptation solutions.

Within Merwedekanaalzone there is a wide variety of solutions available due the experiences from external consultants (OKRA as landscape bureau) and running (pilot) projects (design principles for a climate adaptive Merwedekanaalzone). This especially accounts for water related issues. The active role the water board and province fulfil enlarges the variety of policy options. The water board has a long-standing history of water management and the Province is running pilot projects on climate change adaptation as part of their simulating programme 'inner-city development'. Including such actors enlarges the availability of solutions for climate change adaptation within Merwedekanaalzone. Frihamnen is strongly focussed on the open surface solutions as proposed in the 'invitation for land allocation' and ever since included in the mandate. Additionally, there are

measures to protect the area against rising sea levels and adding green/blue structures for heat stress. Both have been researched prior to the land allocation in the Mistra Urban Futures project.

Technical complexity

The one indicator for this criterion is (1) The level of technical uncertainties among practitioners regarding adaptation planning.

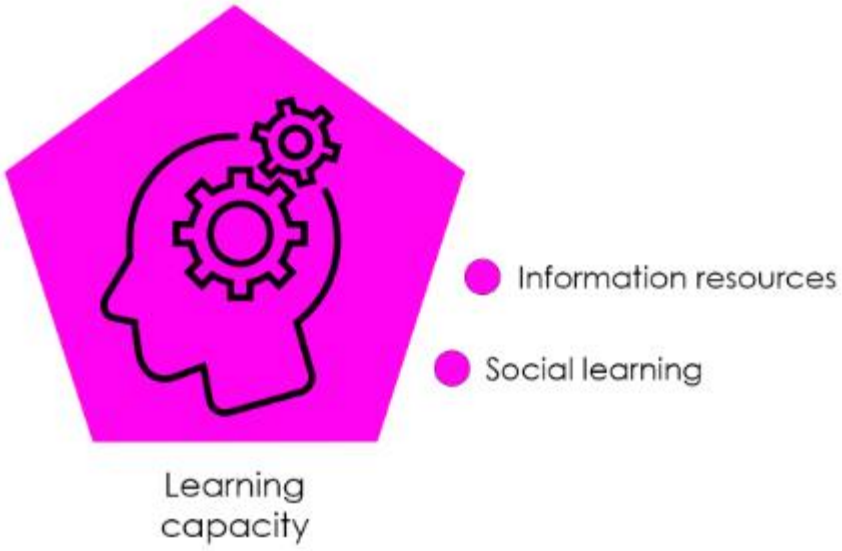
Frihamnen has the highest level of uncertainty with respect to technical feasibility. In Utrecht, technical complexity is not really acknowledged by property developers, it is by municipal officials. On this moment no statements on technical complexity of adaptation measures in Poznan can be made.

Frihamnen started with high level of technical uncertainty, that is there was no knowledge on how 100% rainwater can be retained and processed within a highly urban area without the usage of a drainage system. Throughout the project some adjustments to the initial idea where made as it became clear that it would not be possible to retain and process 100% of the rainwater during construction of the area. On a broader scale, protection measures to sea level rise for the city and rainwater flows have been tested in technical feasibility studies by the City Planning Department. Within Merwedekanaalzone there are some differences, the collective of land owners does not recognise the technical uncertainties that paired with area-wide adaptation structures as the blue/green structure that is being planned. The municipality, who takes responsibility for the blue/green structures after completion, is more concerned with the technical features of the plans as water retention, effects on wind and amount of shading provided. Therefore, they initiated the design research with bureau LINT were calculated were made on these features. The 44MPA project is not meant to developed practical adaptation measures. In the basis, the strategy discusses heat, drought, rainfall in terms of climate change impacts and possible directors for action. As Poznan is in the middle of determining this, it cannot be assessed properly on technical complexity at this point.

Table 7.4. Overview of resource capacity

Conditions/criteria	Frihamnen	Merwedekanaalzone	44MPA
Economic resources			
Affordability	Costs are covered by property developers; finances not discussed, have agreed with baseline adaptation measures	Finances not yet discussed between property developers	Fully covered by the Ministry of Environment and EU, no costs for municipalities except for hours by employees
Willingness to pay	Practitioners see the necessity to adapt in order to build in the area	Climate adaptation as a target, is financially viable as it increases quality of public space	Not yet within Poznan, project has to contribute to this
Financial continuation	Expect for research, there is no prospect of long term adaptation financing	No prospect of long term adaptation financing	Not by Poznan self, there are national funds to apply for
Human resources			
Social acceptance	Mandate triggers motivation to come with viable solution	Practitioners have adopted climate adaptation as a development target	One active municipal actor, rest of the motivation comes from national consortium
Expertise	Stakeholders mutually learn, where necessary consultants are hired	Outsources to one landscape architect bureau with occasionally help from municipality	National consortium is deliberately chosen for their knowledge. Municipal team not experienced
Human manpower	Lot of people working, however, under severe time pressure	Although executed by small amount of practitioners, requested climate adaptation solutions are delivered	Sufficient man power for the project
Technical resources			
Variety of solutions	Several options; open canals, storm flood barriers, flood walls, greenery	Plans do have several options; trees, water squares, green structure, extended waterways	Resulting strategy will propose policy changes, investments, adaptation measures
Technical complexity	Technical complexity within Frihamnen was acknowledge and gradually phased out; often conduct feasibility studies.	Technical complexity not recognized by all the stakeholders at this point; solutions have not been assess on feasibility yet	Too early to tell
	Average		
	Strong	Moderate	Moderate
Main similarities			
-Technical resources are high in every case, practitioners understand that a variety of solutions is needed and -As the focus of this research was on cases which are in the second phase of the adaptation cycle; planning, social acceptance for climate adaptation in terms of motivation and belief by practitioners was already observed among some, if not all, practitioners.			
Main differences			
-Gothenburg and Utrecht have different level of human manpower. Utrecht is regarded more efficient. -How expertise of practitioner is dealt with differs greatly among cases; learn based on mutual expertise, outsource to one expert or national consortium that brings in knowledge.			

7.5 Learning capacity



7.5.1 Information resources

Local knowledge

Two indicators were theoretically derived to measure the strength of this criterion: (1) the extent to which local climatic stressor have been identified and this is being updated, and (2) the extent to which technological and social knowledge are combined and used for adaptation planning.

None of the cases has up-to-date and comprehensive data on all climate change impacts. In the Netherlands, many efforts are observed to generate and disseminate knowledge on spatial and adaptation planning.

The Netherlands has the most advanced knowledge system for climate change impacts on all levels. With actors as Foundation CAS, KNMI, PBL, Deltra programme a lot of information is generated and publically available in policy reports (PBL, KNMI, Delta programme), weather forecasts (KNMI), knowledge databases (Stichting CAS) and GIS-maps (Stichting CAS). These sources cover all climate change themes, such as heat stress, drought, water safety and rainfall. Especially the national GIS-maps are elaborate in contrast to the other cases. They provide layers of heat, rainfall and flood risks, but additionally also provide layers of paved surface as explanation to rainfall retention and heat stress. On a street level, heat stress was mapped in 2011 and will be updated more comprehensively coming year. Other data is lacking on a street level. Sweden has SMHI with Swedish Portal for Climate Change Adaptation. Regionally, the County Administrative Board has been assigned the task to support municipalities in their climate change adaptation effort. City of Gothenburg has identified impacts of sea level rise and excessive rainfall. As mentioned in the case introduction of Poznan, data on climate change related issues is only since recently being recorded and then not on all themes but mostly rainwater. Gothenburg is the only case that has consistency in collecting climate change related data on the long-term as they have money reserved for research.

Risks and vulnerability assessments

The indicators used for this creation are: (1) the execution of system risk and vulnerability assessments, and (2) the extent to which stakeholders are included to give meaning to risk and vulnerability assessments.

For only Poznan an integral vulnerability assessment project will be conducted, as part of the 44MPA. Gothenburg and Utrecht have vulnerability data on some climate change themes.

Step 3 of the 44MPA project is a risk analysis of each participating city, based on an elaborate methodology that takes into account climate change themes as heat stress, droughts and rainfall and applies it to vulnerable sectors and groups as elderly, kids, industries, hospitals. Even though, local stakeholders are not intensively included in this process, there is one workshop were the municipal team is invited to comment on the risk analysis, interpret the data from their perspective and provide critiques or comments. Prior to this, municipal officials were requested to provide data for the assessments to stay as close to the local context as possible. However, there is scepticism about the approach that it cannot be too comprehensive as it is not being executed by local practitioners.

For both Gothenburg and Utrecht, no integral vulnerability assessment has been conducted on a city level. Of these two cases, Gothenburg has much more elaborate data with a focus on rainfall and sea level rise, whereas Utrecht has data on as well heat stress as rainfall and water safety. However, data in Utrecht is not very comprehensive and detailed on a street level. As mentioned 'local knowledge', in the Netherlands some national authorities are active in the field of climate change data. Based on this, several vulnerability assessments are conducted nationally. These should suffice as to raise awareness, but localities are not incorporated. Therefore, the data is not sufficient for local urban planning.

Adaptation policy assessments

Two indicators are applied: (1) the execution of adaptation policy assessments for spatial and/or adaptation planning, and (2) the extent to which stakeholders are included to give meaning to adaptation policy assessments.

In Frihamnen, several adaptation policy assessments have been excecuted, whereas one policy assessment has been conducted thus far in Merwedekanaalzone. In Poznan, adaptation policy options are currently being assessed.

Gothenburg has conducted serval tools to assess potential policy options. They kicked off with the Mistra Urban Futures to assess three possible adaptation scenarios for Frihamnen. Following to this, workshop were organised to test options on their suitability in the area together with all stakeholders. On a larger scale the city has also conducted a feasibility study on the storm flood barriers which have to protect the whole harbour area including Frihamnen to sea level rise on the long-run. Similarly, as mentioned before, the city of Utrecht has executed a design study for a climate adaptive Merwedekanaalzone. Poznan is currently in the fourth step developing an Urban Adaptation Plan, which is assessing adaptation policy options. The results will again be presented before the municipal team for their interpretation and comments. Same note accounts as for risk and vulnerability assessment, it remains debatable to what extent a national consortium can effectively outline adaptation policy options for a municipality.

7.5.2 Social learning

Collaborative learning

Indicators analysed are (1) the extent to which stakeholder exchange knowledge regarding spatial and adaptation planning, and (2) the extent to which stakeholders co-produce knowledge regarding spatial and adaptation knowledge.

Multidisciplinary teams are working on Frihamnen and the Urban Adaptation Plan for Poznan, but not really learning in Poznan. Only Utrecht has one expert landscape bureau working on climate adaptation in the public realm.

In Gothenburg the highest level of collaborative learning is observed as exchanging knowledge among stakeholders was strongly fostered in the workshops. Currently, there are meetings every 2to 3 weeks, which stimulates both exchanging and co-producing knowledge. Merwedeknaalzone has a similar set up with regular meetings were exchanging knowledge is stimulated. For each planning document new research questions are formulated that will have to be answered throughout the project. These questions, however, are being addressed by one stakeholder, which is in relation to climate adaptation the landscape bureau OKRA. Therefore, the planning process is not per se collaborative learning as the number of stakeholders involved in minimal. Likewise, within the 44MPA project exchanging knowledge is strongly enhanced in workshops but there is no collaborative learning as the data is collected and analysed by the national consortium. Municipal actors can react, prioritise bottlenecks and adaptation solutions, but they are not part of the learning process.

Evaluation

Here the following two indicators analysed: (1) the existence of formal procedures to evaluate spatial or adaptation planning, and (2) the extent to which an evaluation is based upon predefined criteria in terms of adaptation goals, objectives and values, yet providing room for narratives.

Frihamnen and the 44MPA project intend to evaluate the spatial and adaptation planning. In Utrecht no evaluation planned for Merwedekanaalzone.

Frihamnen is considered as a prime project for the city as they own the ground they want to experiment with novel adaptation solutions and new planning processes. They are very well aware that this should be accompanied with an evaluation process for both the novel adaptation solution (open surface) and spatial planning process (interactive workshops). Due to the size of and the political interest in the 44MPA project, there are also clear procedures for evaluation this project on a national level. This is done to establish legitimacy as the project is based upon public tender and the consortium will be evaluated on their work. Therefore, predefined goals and targets have been set along a timeline. There has to be mentioned, however, that they are rather abstract and easy to fulfil. For neither spatial nor adaptation planning any evaluation criteria have been defined for Merwedekanaalzone. Moreover, after the urban plan has been finished, it remains unclear if and how the landowners will continue their collaboration. No goals have been set to evaluate this. Arguably, this would leave room for narratives, but no context is provided to evaluate the narratives. Frihamnen and the 44MPA deliberately evaluate the planning process as there is expand the experiences if succesful. The city of Gothenburg wants to use the knowledge for other urban developments in the old harbour and the 44MPA project metrology will be evaluated to potentially be applied elsewhere.

Behavioural internalisation

This entails the following two indicators: (1) the extent to which lessons learnt or experiences are reported for future use, and (2) the extent to which lessons learnt and experiences lead to demonstrable changes in behaviour of stakeholders regarding adaptation planning.

Gradually some behavioural changes are observed among practitioners from Frihamnen and Merwedekanaalzone, but it is too early to tell for the case of Poznan.

As mentioned under the previous criterion, Poznan and Gothenburg show interest to capture the experiences from the current project in policy or practice in order to use it again. This lacks in Merwedekanaalzone, where governmental stakeholders and property developers are learning autonomously from each other. Thus far, the 44MPA project has not resulted in behavioural changes in Poznan yet. The rainfall strategy that is being developed next to the Urban Adaptation Strategy hints towards a behavioural change of more climate change awareness. However, there would not be any intention to familiarise the local planning sector with climate adaptation without the 44MPA project. There is aimed for climate adaptation favourable changes by implementing the Urban Adaptation Strategy, but it is too early to tell. In Gothenburg and Utrecht some behavioural changes are observed among few practitioners. Municipal officials in Utrecht are searching for ways to capture climate adaptation into public policy as their experience is that it will be discarded easily when the financial discussion starts or there is a setback in the project. Moreover, installing a climate adaptation programme manager proves that attitudes for adaptation planning have changed. Even though there is opted for a climate adaptation offices in Gothenburg as well, this has not been pushed through. There are high expectation of the effect Frihamnen's outcomes will have on the behaviour of practitioners, which is that by executing the project many practitioners will familiarise themselves with climate change adaptation.

Table 7.5. Overview of learning capacity

Conditions/criteria	Frihamnen	Merwedekanaalzone	44MPA
Information resources			
Local knowledge	Data on rainfall and sea level rise, not heat stress nor droughts; however, have money for future research	Lot of data from national authorities or agencies, locally data is neither comprehensive	Recently started recording climate change related impacts; only river flooding data is collected
Risk and vulnerability assessment	Have identified risks and vulnerabilities; mandate for future research	Have most risks and vulnerabilities insightful, not interpreted with all stakeholders	Recently finished as part of the project
Adaptation policy assessment	Have executed some assessments with a variety of stakeholders	Not for specifically Merwedekanaalzone, there are various assessment tools available nationally	Is on the agenda of the project to develop policy assessment tools ; debateable how effective if executed by national consortium
Social learning			
Collaborative learning	Learning in collaborative setting, frequent exchange of knowledge	Adaptation planning outsourced to one landscape bureau, consequently not fully understood by all stakeholders	Multiple stakeholders included, but only in three workshops and most of the work is outsourced to national consortium
Evaluation	Intent to evaluate as well planning as adaptation process because of high expectations and learning	No intention to evaluate adaptation solutions	Project will be evaluated and method potentially employed in other cases
Behavioural internalisation	Gradually increasing; projects aimed to familiarise practitioners with climate adaptation	Gradually changes are being made; not on a big scale yet.	Not at this point
Main similarities			
-Climate adaptation certainly not internalised into behaviour among all possible stakeholders. The learning projects have to contribute to this. -Adaptation policy assessments are still under development in all the cases; there have been some experiments, but not applied strategically or commonly.			
Main differences			
-Learning is approached quite differently; in each case learning is pursued but in Gothenburg most intensive attempts are made to achieve this among all stakeholders. -Within each case there is a different focus on a climate change theme; Gothenburg on rainfall and sea level; Utrecht has data on all themes and Poznan has just started recording.			

Chapter 8 Conclusions and discussion

Climate change adaptation is gaining importance within planning processes for urban areas, as the impacts of climate change are becoming increasingly more apparent. Urban actors are becoming more aware of the fact that these impacts will increase in severity if no proper adaptation measures are taken. Mainstreaming of climate change adaptation, i.e. policy integration of climate change adaptation objectives into existing policy domains and in organisational routines, is a promising approach to effectuate climate adaptation in spatial planning. The concept of mainstreaming climate change adaptation is new and there is little understanding of how this task can be accomplished. It is hypothesised that the higher the planning capacity of the planning sector is, the more successful mainstreaming of climate change adaptation will be. This research was executed to contribute theoretical and empirical insights of the different planning capacities to mainstream climate change adaption in spatial planning. To this end, the following research question has been formulated:

WHICH PLANNING CAPACITIES CONTRIBUTE TO MAINSTREAMING OF CLIMATE CHANGE ADAPTATION INTO SPATIAL PLANNING?

Planning capacities in relation to the process of mainstreaming climate change adaptation into spatial planning had not been synthesised into one comprehensive framework. This was executed for this research in chapter 2 to support the case analyses. In chapter 3, the methodology employed throughout this research was explained. Chapters 4 to 6 provided detailed descriptions of the three cases (sub-question 2). Of these three cases, two focused on urban developments; Frihamnen in Gothenburg, Sweden and Merwedekanaalzone in Utrecht, the Netherlands. In addition to these urban development, the 44MPA project in Poland, drafting Urban Adaptation Plans for cities with more than 100.000 citizens, was investigated. The focus for this research was the city of Poznan. The main similarities and differences in the planning capacities of each case were identified in chapter 7. , This was done through a comparative analysis process based on conditions and criteria of planning capacities (sub-question 3). The following final chapter will draw conclusions, assess the level of actionability of certain conditions or criteria which further enhance planning capacities, and end with some policy recommendations which were formulated accordingly (sub-question 4). The chapter is structured as follows; section 8.1 answers the main research question. Following this, there will be a critical reflection on both the results from the thesis and the research methodology in section 8.2.

8.1 Answering the research question

In order to answer the main research and sub-research questions, four aspects of planning capacities will be discussed. First, the planning capacities to mainstream climate change adaptation into spatial planning, as derived from literature, are presented. Second, the extent of the planning capacities across each of the cases will be discussed. This will be followed with a discussion on the interlinkages in planning capacities. Lastly, this knowledge will be applied to assess the actionability of sub-planning capacities, i.e. which action can be taken to improve the planning capacity.

8.1.1 Planning capacities to mainstream climate change adaptation into spatial planning

From an extensive literature review on governing capacities, adaptive capacities, policy development, policy integration, mainstreaming and adaptation governance literature an evaluation framework was developed. The framework was tailor-made to specifically assess capacities of a spatial planning sector to mainstream climate change adaptation into spatial planning. If the planning capacities out from the evaluation framework are met, the more successful mainstreaming of climate

change adaptation into spatial planning will be. This, in turn, will positively affect the implementation of adaptation measures and with that the adaptiveness of an urban area against climate change impacts. The planning capacities are (1) legal capacity, (2) institutional capacity, (3) social capacity, (4) resource capacity and (5) learning capacity. Each planning capacity was further defined into conditions as a prerequisite of a planning capacity. Put differently, the more these conditions are present in a case, the higher the planning capacity is, which is expected to result in more successful mainstreaming climate change adaptation into spatial planning. The same structure as the evaluation framework will be applied to discuss the findings, indicating no order of significance.

The *LEGAL CAPACITY* addresses the presence of 'policy instruments' to enhance climate adaptation in practice and the 'environmental equity' considerations regarding adaptation solutions. Out of the adaptation theory it appeared that 'policy instruments' have to be present for adaptation to take place in the first place. Additionally, these 'policy instruments' must entail a wide variety of instruments; i.e. policy documents, regulatory incentives as zone planning, subsidy programmes. With these, practitioners increase their capacity to undertake legitimate adaptation responses. Within each case examples of 'policy instruments' being employed to effectuate climate adaptation action were found. For example, the programme inner-city development by the Provence of Utrecht to research design principles for climate adaptation. Another example of a 'policy instrument' being use was in Gothenburg, where stakeholders had to sign a mandate to agree on development principles. None of the cases in this research had climate adaptation incorporated legally into spatial planning law. Both 'policy instruments' as tools and legally binding spatial planning laws are an opportunity for the mainstreaming of climate adaptation, though, as results indicate, this does not apply to every legal context as it compromises on the flexibility spatial planning. Geospatial information is increasingly being used to highlight vulnerable areas to climate change and outline spatial plans visually, which enhances 'environmental equity'. It is only being employed in Gothenburg as a 'redistribution policy' that promote environmental equity by making the data assessable to stakeholders and citizens.

In terms of *INSTITUTIONAL CAPACITY*, the research specifically looked at the conditions: 'organisational structure', 'accountability' and 'embeddedness of climate adaptation into public policy'. 'Organisational structure' is very different across the cases, depending on the institutional context. Whilst Gothenburg and Utrecht are 'organisationally well structured' and have climate change adaptation increasingly 'embedded in public policy', Poznan has these conditions weakly represented. A viable balance between 'horizontal and vertical coordination', however, is desirable. Climate adaptation should be implemented on the local level with its own specificities. Though, a central authority that supports local authorities (knowledge generation and dissemination, organisational and financial support) has a strong effect on the institutional capacity. Strong national 'leadership' can initiate this, but should be complemented with strong 'leadership' from local leader that adopts or augments it. Regarding the condition 'accountability', 'transparency on spatial and adaptation planning' ensures that practitioners are informed from the same sources and have the same knowledge base. According to the results in Frihamnen and Merwedekanaalzone, transparency establishes a shared understanding of the planning process and intentions for climate adaptation. This, in turn smoothens cooperation and increases efficiency of adaptation planning, i.e. higher institutional capacity. Due to the novelty of climate adaptation action for practitioners in each case, there is confusion on action with respect to 'responsibility', which limits the institutional

capacity. 'Embedding climate adaptation in public policy or planning documents' is a deliberate choice. Practitioners then have to adhere to ambitions and it ensures long-term adaptation measures over the whole project duration. From this belief, municipal officials advocate for the embedding of climate adaptation as a discourse in policy documents in Frihamnen and Merwedekanaalzone. Consequently, climate adaptation has been included in the planning documents. Within the spatial planning processes, actors other than municipal offices can also pursue climate adaptation solutions. In that case, however, the 'embedded discourse' is then mostly liveable, healthy and green. These actors are not yet included in Poznan, where it is now a municipality centred approach.


Social capacity

For *SOCIAL CAPACITY* a distinction was made between the conditions: 'network participation', 'stakeholder engagement' and 'community engagement'. Scores on social capacity were generally strong due to the conditions 'stakeholder engagement' and 'community engagement'. Theoretically, 'stakeholder participation' is considered to be of importance as it creates a sense of ownership on the adaptation solutions, opposed to when it is forced. Mainstreaming climate adaptation into the routines of all relevant stakeholders will be more logical and natural when practitioners have a sense of ownership and are engaged. This was seen to be the highest in Gothenburg because many stakeholders are involved with designing and contextualising the adaptation solutions. In Merwedekanaalzone and Poznan. a considerably lower level of social capacity was observed. In the case of Merwedekanaalzone, climate adaptation was outsourced to one bureau with often information moments, whereas in the 44MPA project a national consortium develops an Urban adaptation plan for Poznan with just three interactive workshops with municipal officials. These differences result in Gothenburg's climate adaptation to be better mainstreamed into other spatial planning projects, as a wider group of stakeholders are familiar with adaptation. 'Community engagement' can steer climate adaptation in spatial planning by advocating for it; in Western democracies elected officials must answer the community wishes. Even though in both Frihamnen and Merwedekanaalzone 'community engagement' is fostered during the planning processes, the community is being more strongly engaged in Merwedekanaalzone. This is due to the fact that there is already city life and the area is transforming, whereas Frihamnen was previously a cut-off harbour area. 'Community engagement' in Poznan is arbitrary for spatial planning as it is advised by city hall but not actively executed, and non-exciting for adaptation planning. It is believed that Polish citizens are not aware of the impacts of climate change on urban areas.


Resource capacity

RESOURCE CAPACITY has been divided into three conditions: 'economic', 'human' and 'technical' resources. With respect to resource capacity, it can be said that in all three cases there are different financial arrangements that hint towards 'sufficient budget' for the adaptation measures. However, both Frihamnen and Merwedekanaalzone are in the designing and planning phase and still have not discussed finances in much detail. The 44MPA project is fully covered. 'Long-term financial securing for adaptation planning' is not established, even though this is important for adaptation planning. Climate adaptation concerns experimenting and changing adaptation assumptions, which could require adjustments to the implemented adaptation measures and corresponding financial situation. Each of the cases heavily invested in strengthening 'human resources', mostly in terms of 'expertise'. There is awareness that 'expertise' is required and needs to be built. Where necessary, external experts are hired to build 'expertise' within the planning sector. 'Technical resources' provide great opportunities for planning sectors to adapt. There are two preconditions: resources had to be 'technically feasible' and a 'variety of solution's are required as no single measure can adapt a whole system at once. This is being recognised and actively conveyed in

practices; solutions are tested on feasibility and consequently several solutions are integrated. Testing in Frihamnen is most profound as they have executed concrete calculations on the proposed adaptation solutions, such as on water capacity of open surface canals. In Merwedekanaalzone it is purely designed at this phase and adaptation solutions are not fully assessed on technical uncertainties yet.

'Information resources' and 'social learning' were identified as conditions for *LEARNING CAPACITY*. Regarding the condition 'information resources', it is a prerequisite to supported deliberate decision-making. Put differently, it supports practitioners to understand and practically cope with climate adaptation. Tools to 'assess vulnerability and adaptation options' contribute to this support, as was found in each case. 'Social learning' can be encouraged through learning networks and organisational arrangements because adaptation is not fixed, nor confined to one discipline. In the cases of Gothenburg and Poznan, this is highly valued and believed to contribute to the implementation of climate adaptation. Stakeholders get a better grip on the issue not only themselves, but also as a collective group through 'learning' and 'evaluation' of implemented adaptation solutions. If executed correctly, this will translate into 'behavioural changes', i.e. reacting or anticipating on experiences and novel assumption that alter behaviour to effectuate climate adaptation. However, this takes time, as learning precedes behavioural change and therefore was not yet observed in any of the cases.

8.1.2 Extent of planning capacities across cases

To consistently assess the extent of planning capacities across the cases a 'grading scheme' was developed consisting of three grades: weak, moderate and established (see section 3.3.2). The grading was designed to highlight the main similarities and differences in efforts of planning sectors in the cases to mainstream climate change adaptation into spatial planning. The grading results from chapter 7 are synthesised into table 8.1, highlighting the grades for each of the conditions. See table 8.1 on page 101. The following section will elaborate on the extent of planning capacities across cases.

Three cases were strategically chosen to represent different levels of advancement when adapting to climate change within the planning phase of the adaptation cycle. All of the cases had expressed their ambitions to mainstream climate change adaptation, but differ in their current stages of mainstreaming climate adaptation in spatial planning. Of the cases, Frihamnen was chosen to represent the highest level of climate adaptation; Merwedekanaalzone second and lastly Poznan. Therefore, the overview is given per case to pinpoint the main similarities and differences.

Overall *LEGAL CAPACITY* was determines to have the weakest presence of all five planning capacities. This was largely due to a moderate to weak score on the conditions 'policy instruments' and a weak score on the condition 'environmental equity' across all cases. Although 'policy cohesion' is established between the 'policy instruments' present in Frihamnen and Merwedkanaalzone, there is still a lack in useful 'policy instruments'. For Frihamnen, there were observed some strong municipal 'policy instruments', but a lack of 'policy instruments' being used on other governmental levels. Merwedekanaalzone has no strong 'policy instruments' being applied on a municipal level, but was found to have some 'national policy efforts' to stimulate climate adaptation. In Poznan there were no 'policy instruments' that address climate adaptation being implemented yet. The 44MPA project in Poland will be the first effort to integrate climate

adaptation into spatial planning in Polish cities. Before this, there have been spatial measures that can be related to climate adaptation but are not labelled as such. Grading on 'environmental equity' shows great variation. As mentioned earlier, Gothenburg and Utrecht have GIS-data on climate change vulnerabilities and deliberately apply this knowledge to draft policies and reduce the city's vulnerability to climate change. However, Gothenburg is the only city that has provided easy access to this data online. The city of Poznan was until recently not keeping record of damage caused due to climate change as rainfall or extreme droughts. The city of Utrecht has such information, but it is highly fragmented over municipal departments and not accessible for anyone whom is interested.


Institutional capacity

The conditions for *INSTITUTIONAL CAPACITY* have not yet been fully met by any of the three cases. 'Organisational structure' scored differently across each case. 'Support from the leadership' was generally quite strong due to the size and ambitiousness there was political involvement in each case. 'Cooperation between governmental' levels was found to be low in Frihamnen, but strong in Merwedekanaalzone and Poznan. 'Accountability' was scored either moderate or low. 'Transparency' scored well in Frihamnen and Merwedekanaalzone, but the overall score was lowered due to 'unclear division of responsibilities' and the absence of an 'individual or group that can be held accountable' for climate adaptation. 'Embeddedness of climate change adaptation into public policy' shows maximal variation between the cases on the 'discourse embeddedness' and the 'formulated goals and targets for climate adaptation'.


Social capacity

From the three conditions of *SOCIAL CAPACITY*, the conditions: 'stakeholder' and 'community engagement' have strong differences in scores. The condition 'network relatedness' is quite similar over the cases. Regarding the latter condition, each case has some relatedness to a relevant network either nationally (as in national government efforts Utrecht), internationally (Gothenburg through conferences) or on a project basis (Poznan through the 44MPA project). However, expect for Poznan, none of these networks is profitably exploited in terms of extracting best practices or relevant knowledge. 'Stakeholder engagement' is scored either established or moderate. These scores are explained by inclusive and equal stakeholder participation with co-developed solutions in Gothenburg and limited stakeholder participation in Merwedekanaalzone and Poznan. In the latter two cases the climate adaptation aspect of the project is limited to only a few stakeholders. The conditions 'community engagement' shows maximum variation in scores among the cases. In Merwedekanaalzone the community is actively informed and given feedback moments in the decision-making process. Results in Frihamnen and the 44MPA project indicated that the community is not always concerned with spatial nor adaptation planning. In such cases, the strength of the 'community engagement' condition scores low and a different approach should be developed. There is no clear evidence that the higher level of 'community engagement' in Merwedekanaalzone resulted in considerable more climate adaptation in the spatial plans.


Resource capacity

The conditions for *RESOURCE CAPACITY* have overall a moderate or established score for all three cases. The conditions 'economic resources' remains uncertain in long-term projects, as in Frihamnen and Merwedekanaalzone the financial situation can change and no precautions are being taken at this point. Thus the financial continuation of climate adaptation within a project is unsure. In Friahmnen and Merwedekanaalzone, the condition 'human resources' were scored as established. It was acknowledged that expertise on climate adaptation is required and practitioners are motivated to work with this novel challenge. this is also

acknowledged in the 44MPA project, not established yet, but nonetheless in progress. Regarding the condition 'technical resources', scores are quite well because it is reckoned that climate adaptation comprises of several solutions; there is no one-size-fits-all solution. It is, however, only Frihamnen that has assessed technical uncertainties profoundly.

The *LEARNING CAPACITY* was either graded moderate (Merwedekanaalzone and 44MPA) or established (Gothenburg), while within each case both conditions 'information resources' and 'social learning', are regarded as important by respondents. Information resources on all climate change themes was only observed in Merwedekanaalzone, and then not all very accurate. Assessments on vulnerability and adaptation policy were seen to increasingly being applied across the cases. 'Social learning' was determines to be strong in Frihamnen due to the incorporation of multiple stakeholders and evaluations. In the other cases this requires some improvement. According to respondents, learning contributes to successful integration of climate adaptation into the project in Frihamnen.

Table 8.1. Strength of conditions per planning capacity

Planning capacity / conditions	Frihmamnen	Merwedekanaalzone	44MPA
Legal capacity			
Policy instruments	Moderate	Moderate	Weak
Environmental equity	Moderate	Weak	Weak
Institutional capacity			
Organisational structure	Moderate	Moderate	Moderate
Accountability	Moderate	Moderate	Weak
Embeddedness of climate adaptation	Established	Moderate	Weak
Social capacity			
Network relatedness	Moderate	Moderate	Moderate
Stakeholder engagement	Established	Moderate	Moderate
Community engagement	Moderate	Established	Weak
Resource capacity			
Economic resources	Moderate	Moderate	Moderate
Human resources	Established	Established	Moderate
Technical resources	Established	Moderate	Moderate
Learning capacity			
Information resources	Established	Moderate	Moderate
Collaborative learning	Established	Moderate	Moderate

8.1.3 Interlinkages in planning capacities to mainstream climate change adaptation into urban planning

Discussed thus far in this research were the five-planning capacities and their conditions independently. However, all conditions are closely inter-linked in reality and studying there interlinkages supports a more profound understanding of some of the critical and less crucial conditions for planning capacities. Four main interlinkages will now be discussed in the following section.

The first interlinkage that was found is between the criteria 'collaborative learning', 'horizontal and vertical coordination' and 'organisational structure'. As mentioned in the previous section, 'collaborative learning' is found important in each case and therefore, although differently, was given some weight in the planning process. In the Netherlands and Poland there is national guidance on climate adaptation ('vertical coordination') which stimulates learning on the municipal level. Due to an absence of this, the city of Gothenburg has internalised this learning by setting up learning procedures for Frihamnen. Furthermore, the extent of 'collaborative learning' is related to the 'organisational structure'. In Merwedekanaalzone the landowners trust a bureau to properly develop climate adaptation solutions in a given timeframe. The 44MPA project is of considerable size, so much so that it is considered most efficient if a national consortium does all the work and then communicates this to practitioners in an interactive setting. In Frihamnen, in contrast, believes that co-developing at the beginning of a process will deliver efficiency in a later stage; meaning no more discussion during construction as everybody is on the same page. The extent of 'learning' can be stimulated by the 'organisational structure'.

A second interlinkages which was identified during this research regards the condition 'embeddedness of climate adaptation into public policy'. This criterion was linked with the criteria 'social acceptance' of climate adaptation among practitioners and 'a clear division of responsibility'. In each case, it started with 'discourse embedding' in the planning documenters by integrating novel climate adaptation targets for the projects. The novelty results in high motivation and belief ('social acceptance') among practitioners. However, 'discourse embedding' and 'formulating targets' without considering the 'responsibilities of climate adaptation' will hamper climate action. Having spoken with multiple practitioners it became obvious that 'unclear responsibilities' triggers frustration, which can decrease motivation and belief ('social acceptance') of practitioners to pursue climate adaptation. This became clear in Gothenburg where municipal departments were co-creating the adaptation solutions, which initially led to motivation to address a novel challenge. However, as today, it is not clear yet which departments will have responsibility over the adaptation solutions when implemented and during the design phase, there is no clear manager on the adaptation solution. The municipal departments continue because of their motivation and belief ('social acceptance'), but indicated that this could decrease in time as it leads to inefficient action. This was found to be different in Merwedekanaalzone where one bureau is appointed for climate adaptation, resulting in a much quicker process. It is thus important to accompany embeddedness of climate adaptation, which triggers social acceptance, with a clear division of responsibilities.

A third interlinkage that was identified is between three criteria; 'information resources', 'discourse embedding' and 'community participation'. Climate change knowledge ('information resources') is, for municipalities, crucial data for their actions, used to draft policy and embed climate adaptation into public policy. However, in each case not all relevant climate change data that is being gathered is

also embedded in public policy as discourse. In Frihamnen climate adaptation is well embedded because there is an urgency; the area is highly prone to sea level rise. This urgency establishes legitimacy for the planning sector. In Merwedekanaalzone there is not the same sense of urgency being felt, but rather 'climate adaptation is an add-on'. Here Healthy Urban Living is the overarching 'embedded discourse' of which climate adaptation is one aspect. The 'discourse embedding in public policy' related heavily with the 'community participation'. Public policy is drafted to establish legitimacy. If a community is not concerned with climate adaptation, then the 'discourse embedding' will decrease. In Merwedekanaalzone there is no direct urgency, so climate adaptation is embedded differently. The effect is even stronger in Poznan, where governmental officials state that climate change should not be mentioned towards the community. There is no awareness, urgency, nor sense of responsibility among the community to act. Hence actions to protect citizens to climate change related issues (as flooding or droughts) are not directly linked to climate change yet in public campaigns. This shows that there can be climate action without community participation and it depends on the context to what extent the community should be included.

'Discourse embedding' also appeared to interrelate to the criteria 'stakeholder participation', 'willingness to pay' and 'statutory compliance'. As described in the previous paragraph, climate change related information can be a source for legitimate action by municipalities. Urban actors as investors and property developers might have other motivations to adapt to climate change. Identifying co-benefits ('willingness to pay') appeared to be of interest in the cases. Urban actors aim is to provide high quality public space within the high densities. Especially when climate change adaptation has no legal enforcement, broadening the scope of climate adaptation is advisable in order to achieve desired adaption measures ('statutory compliance'). Developers mention climate change adaptation because it enhances liveability of an area, not because of their intrinsic motivation to tackle climate change. This can relate to the fact that liveability increases ground prices that increases the property developers' final revenues. This is clear from Gothenburg where property developers prefer small, visible measures over big measures (that are not visible like the storm barriers). It is recommended that climate adaptation measure are made into no-regret measure that benefits the interest of all stakeholders and the planning area in multiple ways. By doing this, investors and property developers are willing to pay'. This is of importance as they are the actors paying for the public space, and therefore also climate adaptation measures in both Frihamnen and Merwedekanaalzone. From this interlinkage, it can be said the discourse regarding climate adaptation should be embedded in a way that it triggers 'stakeholder participation' when a legal basis in spatial planning law is absent. It is advised to identify both positive and negative perceptions that stakeholders may have of climate adaptation planning. Subsequently, undertaking action to address these perceptions through learning techniques, such as generating and disseminating knowledge, learning workshops, conducting research, look for best practices in networks is recommended. Highlight positive perceptions as co-benefits and resolve the negative ones.

To conclude, the identified interlinkages suggest that in some cases multiple conditions mutually need to be addressed to improve the planning capacity of a planning sector to mainstream climate adaptation into spatial planning.

8.2.4 Actionability of planning capacities

Based on the previous sections which discussed the identification of the planning capacities to mainstream climate adaptation into spatial planning, the extent of their presence and their interlinkages, it would be interesting to appraise which actions can be taken to raise the level of planning capacity. These actions are formulated as recommendations that can be applied by practitioners. Outstanding strengths across cases will be discussed and opportunities for action will be identified below.

- The strength of Frihamnen's approach is partly due to their emphasise on learning. As mentioned in the previous paragraph this can be stimulated by the organisational set-up. For example, inter-sectoral working should be enhanced for collaborative learning processes. It can also be triggered, as in the case of Merwedekanaalzone, through guidance from provincial or national authorities by providing the required infrastructure for learning (online databases and physical conferences or workshops).
- Another condition were Frihamnen excels compared to the other cases is 'environmental equity'. This was determines to be because of the case's transparency and accessibility on climate change data. In the city of Utrecht, such data is at hand, but not centrally organised nor accessible online. This could be improved by making such data available on one website. The same accounts for Poznan, which has recently started measuring weather events in relation to climate change.
- The way climate change adaptation has been embedded as a discourse in public policy and targets that have been formulated accordingly is a strong feature of Frihamnen. As described in the previous section, embeddedness of climate adaptation can foster social acceptance among practitioners. Framing, as in Frihamnen, climate adaptation as a shared problem that requires a shared vision on the adaptation approach, will result in a higher commitment of stakeholders. It is therefore advised that practitioners are brought together at an early stage of the planning process to highlight the climate change impacts and start working towards a shared vision in the proper adaptation measures. This advice is reinforced from the results of member-checking interview that suggested that discourse embeddedness and social acceptance itself are not enough. To substantively upscale climate adaptation from pilot projects expected by a motivated few to a system wide standard, there needs to be a basis in policy documents with a more regulatory or legal basis (condition policy instruments).
- A strength of all three of the cases are the efforts to establish an adequate level of human resources. Especially when compared to researched conduct in 2012. This research concluded that big cities lacked the required knowledge and know-how for climate adaptation planning (Mees & Driessen, 2012). However, there should continuously be investments in training programmes for staff and other stakeholders to maintain and further improve this knowledge base.
- Support from leadership can be triggered to rule out the political and sensitive side of climate change. This was seen to be strong in the city of Utrecht where spatial adaptation is openly discussed. Treating climate adaptation as an integral part of climate policy by coupling it with, for instance, mitigation, will assist in creating no-regret measures (Measham et al., 2011).

Furthermore, some points of improvement were identified for planning sector to employ:

- As concluded in 8.1.1, within each case the environmental equity criteria was grade 'weak'. Environmental equity can be easily enhanced when geospatial technologies are applied to relate vulnerable social groups to climate change impacts, and accordingly undertake action. The geospatial technologies are already being applied to synthesise data, but the last step towards vulnerable groups has not been taken.
- Moreover, an unclear division of responsibilities for climate adaptation was observed in each case. It was also determined that these unclear responsibilities will decrease motivation of practitioners. The member-checking interviews showed that climate adaptation action has to come from all practitioners (everybody is partly responsible), but it is recommended that each planning sector creates a group of appoint an individual to be in charge of climate adaptation. This group or individual can be employed to steer, coordinate and oversee climate adaptation action.
- Financial continuation was the only criteria of economic resources which was graded weak in all cases. This ensures long-term trajectories that, to a certain extent, can withstand changes in the context, which can be shift in political support or decrease in affordability due to a crisis. It is recommended for each case, that they do not spend the budget for climate adaptation immediately but put aside a certain percentage to ensure resources for climate adaptation action can be accessed when needed.
- A potential to improve the learning capacity is including more stakeholders with the interpretation of climate change data. In Merwedekanaalzone, the highest level of climate change information was found. Despite this, more effort should still be given to interpreting this data with all practitioners, to further stimulate usability of the data. Accordingly, in the Netherlands a new national policy document (Delta Plan Spatial Adaptation, September 2017) has also identified this point and suggest to make all stakeholders co-owners of the problem.
- Poznan is in the midst of developing a strategy for climate change adaptation and in the Netherlands, municipalities will need to have one by 2020 (Delta Plan Spatial Adaptation, September 2017). This substantively contributes to the discourse embeddedness and presence of policy instruments. The former appeared to be of great importance out of the identified interlinkages, thus also it is recommended that Gothenburg should consider drafting an integrated climate adaptation strategy.

8.2 Discussion

This research started off with identifying the knowledge gap surrounding the mainstreaming of climate change adaptation into spatial planning: a lack of an integral framework that synergises many influential factors to mainstreaming climate adaptation into one framework and views the contextual varieties mutually. This research has addressed this gap by developing an evaluation framework and furthermore, applied the framework to three unique cases. In this final section of the research, a reflection is given upon, firstly, the results and, secondly, the research methodology.

8.2.1 Theoretical discussion of results

Through grounded speculation (comparing empirical data to theoretical concepts) this research aimed to speculate on what views or features underline the main similarities and differences (Verschuren & Doorewaard, 2010). It was hypothesised that the higher the planning capacity is, the more successful mainstreaming of climate change adaptation into spatial planning will be. In order to have planning capacities certain conditions of these planning capacities have to be met. Improving planning capacities will results in more successful mainstreaming of climate change adaptation.

However, when is climate change adaptation successfully mainstreamed? This research highlighted that mainstreaming of climate change adaptation into spatial planning is inherently paired with a level of complexity. Gifford's (2011, p.292) notion of environmental numbness captures the level of complexity that is paired with the comprehensiveness of the evaluation framework: "every environment is composed of more cues and elements than individuals can wholly monitor, so we attend to environments selectively''. This evaluation framework is not an attempt for individuals to master every conditions and aspect of it. The components are made more manageable by breaking sub-capacities up into detailed elements (conditions and criteria), which individuals can comprehend. Moreover, individuals in a planning sector mutually can potentially grasp all the components of the evaluation framework by combing stakeholders' strong features. In relation to the complexity of climate adaptation, decision-makers can be susceptible to contingency, which refers to always having to choose between a possible and chosen action (Renn, 2008). Choosing either has consequences in the sense that a choice for planned adaptation can possibly be reversed when the consequences turn out to be predominantly negative, but the old situation can never fully be restored (Renn, 2008). Even though the evaluation framework developed is no tool to precisely predict consequences of possible actions, the framework can be deployed to address interlinkages in conditions and criteria of sub-capacities, as highlighted in 8.2.3. This is beneficial to identify possible consequences and trends of interventions in planning capacities. It is believed that this supports more deliberate decision-making.

Specifically in relation to the concept of mainstreaming, there is some vagueness in interpreting mainstreaming of climate change adaptation in relation to the traditional dedicated approach. Sometimes mainstreaming is regarded an end rather than a mean by practitioners. The city of Rotterdam started of climate adaptation action with a mainstreaming approach. After a while it transformed unconsciously into a dedicated approach as an climate adaptation programme was established with own staff members and project portfolio. Yet municipal officials themselves claimed to apply a mainstreaming approach, because this is what municipal officials preferred as it would increase effectiveness and efficiency. This sometimes blurred line between the mainstreaming and dedicated approached leads to different interpretation in practice and science (interview Uittenbroek, 20 July 2017). The evaluation framework is not developed to argue against practitioners whether or not they are applying either a mainstreaming or dedicated approach, but as a tool to

improve the state of climate adaptation in spatial planning practices, either through a mainstreaming or dedicated approach.

Furthermore, the evaluation framework was applied on cities that struggle with enhancing the planning capacities to advance in the adaptation cycle from the planning phase to the managing phase. When analysing climate adaptation or any novel policy objective, one should take into account that it usually takes time for a policy objective to evolve. This is widely described in policy transition literature. Prior to a 'breakthrough' of a policy objective, i.e. where structural changes in the policy context occur, there is a period of 'predevelopment' and 'take-off'. It differs per policy objective and context in which it advances how long it takes to achieve a 'breakthrough' (Rotmans, Kemp & van Asselt, 2001). As breakthrough strategy Wittmayer & Loorbach (2016) advise to gather frontrunners from policy, science, business and civil society to develop a shared understanding of joint complex transition and start experimenting. However, as highlighted by member-checking interviews, it is beneficial to include non-frontrunners rather too early than too late in this process to enlarge support and legitimacy. This may support advancement of novel policy objectives from pilots to mainstream.

The research framework is built on the assertion that cooperation is required for climate adaptation as this is the foundation of mainstreaming literature (Glucker et al., 2013; Wittmayer & Loorbach, 2016; Uittenbroek, 2016). However, this does not account for Poland. In Poland, a recent study shows that Poles are not taking any actions to stimulate inter-sectoral cooperation. Poles are not willing enough to integrate and act on behalf of the common good. There is a possibility that legacy of the communist period is still present in people's values, culture and behaviour (Sakowisz, 2017). This does not mean that the overall planning capacity to mainstream climate adaptation into spatial is consequently low, as it can be brought into balance by other sub-capacities. This is a valuable feature of the framework, it identifies strengths and weaknesses of a planning sector, addresses planning capacities as a balanced set of conditions; no single condition is decisive (Koop et al., 2017).

8.2.2 Discussion of research methodology

The previous section reflected upon the results theoretically, in the following section the research methodology will critically be discussed. Four aspects of this research will be discussed: the research framework, the research methodology, the research results and directions for future research.

The evaluation framework has proven to be of great use to evaluate planning capacities to mainstream climate adaptation into spatial planning. Through a comprehensive and integral set up of the framework, all relevant influential factors were analysed. At the same time, it was comprehensible for practitioners and respondents. The results are specific and go to a detailed level. This hopefully supports the planning sectors to mainstream climate adaptation into spatial planning by targeting specific conditions or criteria. When applying the framework, attention has been paid to three features: firstly, the framework allows for an assessment of the relative importance of conditions and criteria. In order to do this, one should very clearly outline the context to understand the interface in which the conditions and criteria function. This is why a detailed introduction should accompany the evaluation provided. Secondly, the evaluation framework can only be applied as a tool to compare cases if the cases are somewhat similar. For instance, the score 'moderate' for affordability in this research might be scored 'established' in a developing country. Therefore, a set selection criteria for the case section have to be developed and shared to stimulate replicability of the research. Lastly, one should be consciousness when interpreting results. Sometimes results on

conditions and criteria varied greatly among cases, but the grading can be the same. Hence, an interpretive approach within the context of the evaluation framework was practiced.

With respect to the research methodology, there is an aspect of subjectivity inherently linked with interpreting data. To rule out the level of subjectivity, a predefined simple grading matrix was developed. One should be aware that this is not developed as exact science, but as a support tool to identify trends in similarities and differences across cases. By accompanying the grading with elaborate textual explanations the transparency is increased.

Regarding the selection of respondents, a wide variety of stakeholders were interviewed because they mutually determine the level of mainstreaming of climate adaptation into spatial planning. For this purpose they were not randomly selected. Arguably, this could mean that they are not representative for the whole planning sector as all respondents had some affinity with adaptation. It was not an issue for this research as the cases were deliberately chosen as cases that aim to include climate adaptation. With other research, however, respondent identification should be considered thoroughly.

Lastly, with respect to the results three statements should be taken into consideration. Firstly, through triangulation of research methods and sources in combination with a consistent evaluation framework, meaningful results could be deducted that have a high internal validity and, to some extent, also external validity. Including more cases would increase the external validity more. However, this was not possible within the scope of this research. Secondly, even though projects were chosen within a city, this research also brings forth information on the transition of climate adaptation policy in the cities where the cases are located. Lastly, results of an evaluation will outdate soon as the context is rapidly changing. Therefore, the results should be used critically when a bit older, and preferably regularly updated.

In terms of suggestions for future research, it would be valuable to increase the number of case-studies to further test and strengthen the evaluation framework. Furthermore, expand it in other contexts (e.g. other stage of mainstreaming climate adaptation) to see which conditions and criteria still hold. Furthermore, applying the evaluation framework on one organisation or governmental agency (e.g. a municipal department or property developer), or on a specific topic of climate adaptation governance (e.g. organisational structure of climate adaptation), would provide more in-depth knowledge on aspects of climate adaptation. This, in turn, can foster mainstreaming of climate adaptation into spatial planning. Specifically for the Netherlands, relating the framework to the upcoming Environment and Planning Act would be valuable for practice. Currently, stakeholders are searching on how climate adaptation should be included in this new piece of legislation. Furthermore, the results showed that the organisational structure of projects appeared to be of importance for the mainstreaming of climate adaptation into spatial planning. Future research should, based upon organisation literature, outline efficient and effective organisational structures for the mainstreaming of climate change adaptation into spatial planning. Finally, it would be interesting to identify stimuli and barriers to mainstreaming of climate adaptation into spatial planning and establish causality relations between certain planning capacities and stimuli and barriers to this.

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Appendices

Appendix 1 – List of relevant documents; Frihamnen, Gothenburg

Document name	Year	Government level	By whom
Spatial planning			
Comprehensive Plan	2013	Municipal	City Planning Department
RiverCity Gothenburg Vision	2012	Municipal	City Planning Department & Alvstranden
Gothenburg 2035; Development Strategy	2014	Municipal	Planning and Building Committee
Stigande Vatten; handbok for fysisk planering	2011	Regional	Västra Götalands
Planning and Building Act	1987	National	National government
Climate change adaptation			
Who is responsible?	2017	National	State public investigations
Regional handlingsplan för klimatanpassning	2014	Regional	Västra Götalands
Action plan Climate Programme	2014	Municipal	Environmental Department
Environmental Programme	2013	Municipal	Environmental Department
Avledning av dag-, drän- och spillvatten	2016	National	Svenskt Vatten
Integrated energy and climate policy	2009	National	City of Gothenburg
Sweden facing climate change - threats and opportunities	2007	National	Swedish commission on climate and vulnerabilit
Swedish Environmental Code	1998	National	National government
Other			
MinStad (planning website)		Municipal	City Planning department
Vatten i gotenburg (website climate change impacts)	2017		City Planning / Water and Recycling
Frihamnen			
ÄLVSTRANDEN UTVECKLING ÅRSREDOVISNING	2016	Municipal	ÄLVSTRANDEN UTVECKLING
Detaljplan för Blandstadsbebyggelse i Frihamnen, etapp 1	2016	Project	City Planning Authority
Invitation to land allocation for Frihamnen		Project	Älvstranden Utveckling
Frihamnen etapp 1; sammanfattning av workshop	2015	Project	Älvstranden Utveckling
PROGRAM FÖR FRIHAMNEN OCH DEL AV RINGÖN	2014	Project	City Planning Authority

Appendix 1 – List of relevant documents; 44MPA, Poznan

Document name	Year	Government level	By whom
Spatial planning			
Smarth growth Operational Programme for Poland 2014 – 2020	2014	National	National government
Master Plan dla Poznańskiej Koleji Metropolitarnej	2013	Municipal	City of Poznan
Poznań Regional Operational Programme for 2013-2020	2013	Regional	Regional authority
Development Strategu for the city of Poznan - 2030	2010	Municipal	City of Poznan
Spatial Planning and Spatial Development Act	2003	National	National government
Climate change adaptation			
the Environmental Protection Programme	2013	Municipal	City of Poznan
Flood Directive Poznan		Municipal	City of Poznan
Polish National Strategy for Adaptation to Climate Change	2013	National	Ministry of the Environment
Development strategy, river water in Poznan, Poland	2012	Municipal	City of Poznan; Royal Hashkoning DHV; KuiperComp
Other			
Summary of the Partnership Agreement for Poland, 2014-2020	2014	European	European Commission
Bydgoszcz waterproof	2012	Municipal	City of Bydgoszcz
44 MPA project			
44MPA website	n.d.	project	Ministry of Environment
SENSITIVITY TO CLIMATE CHANGE IN THE CITY OF KALISZ–CASE STUDY	2016	municipal	Institute of Environmental Protection
Terms of reference - project coordinator	2015	project	Ministry of Environment
Klimada project outcomes	2013	National	Institute of Environmental Protection
Adaptation manual for cities	2012	National	Institute for Ecology and Industrial Areas

Appendix 1 – List of relevant documents; Merwedekanaalzone, Utrecht

Document name	Year	Government level	By whom
Spatial planning			
Environment and Planning Act		National	National government
Actualisatie Groenstructuurplan 2017 - 2030	2017	Municipal	City of Utrecht
Ruimtelijke Strategie 2016: gezonde groei	2016	Municipal	City of Utrecht
Kadernota Kwaliteit Openbare Ruimte	2016	Municipal	City of Utrecht
Revision Provincial Regulation Plan 2013-2028	2016	Provincial	Province of Utrecht
Spatial Strategy; Utrecht	2016	Municipal	City of Utrecht
Wet Ruimtelijke Ordening	2008	National	Ministery VROM
Structure vision Utrecht 2013-2018	2004	Municipal	City of Utrecht
Space for the Rivers	1996	National	Ministery VROM
Climate change adaptation			
Deltaplan Spatial Adaptation	2017	National	Ministery of Infrastructure and Environment
Evaluation Delta Programme	2017	National	Ministery of Infrastructure and Environment
National Adaptation Strategy	2016	National	Ministery of Infrastructure and Environment
Adaptation to climate change	2015	National	PBL and Knowledge for Climate
Action plan coalition spatial adaptation	2015	Regional	Nine regional authorities
Memorandum of Understanding Spatial Adaptation	2015	Regional	Nine regional authorities
Climate Proof Cities - final report	2014	National	Knowledge for climate
Delta Resolution Spatial Adaptation	2014	National	Ministery of Infrastructure and Environment
Stedelijke warmte-eiland Utrecht	2013	Municipal	NMU
National Delta Programme	2010	National	Ministery of Infrastructure and Environment
Make space for climate	2007	National	Ministery of VROM
Klimaatakkoord	2007	National	Ministry of VROM and regional/local authorities
Other			
Green Structure Plan	2017	Municipal	City of Utrecht
Plan Municipal Water Tasks	2017	Municipal	City of Utrecht
Utrecht2014	2010	Regional	Province of Utrecht
Water Act	2009	National	National government
Merwedekanaalzone			
Stedenbouwkundig plan; deelgebied 5	2017	Project	Collective of owners
Omgevingsvisie Merwedekanaalzone	2017	Area	City of Utrecht
Merwedekanaalzone: naar een duurzame stad	2016	Project	City of Utrecht
Merwedekanaalzone klimaatadaptief		Project	Province of Utrecht
Ontwikkelambitie MeerMerwede	2015	Project	MeerMerwede
Ontwikkelperspectief MixMerwede	2012	Project	MeerMerwede

Appendix 2 – List of respondents

Name	Organisation	Function
Utrecht		
Wouter Egas	Province Utrecht	Advisor area development
Erwin Rebergen	Municipality Utrecht	Advisor urban water
Floris Grondman	MeerMerwede	Landscapearchitect
Dries Schuwer	Water Board HDSR	Advisor space and water
Marcel Janssen	Municipality Utrecht	Spatial director Merwede
Dick Helsloot	BPD	Business developer
Jurjen van Keulen	Municipality Utrecht	Senior project-manager
Jordy Stamps	Marco.Broekman	Architect
Bas Heessels	OKRA	Landscapearchitect
Maya van den Berg	University of Twente	Researcher
Gothenburg		
Ulf Moback	Planning department	Landscape architect
Mia Edstrom / Shraddha Kapri	Planning department	Project leader / Planarchitect
Anna Georgieve Lagell / Lars Westholm	County administrative board	Coordinator CCA / Urban Planner
Jonas Dahlstad	Ramboll	Director
Per Kristerson	GR:Goteborgsregionens Kommunalforbund	Senior planner
Krister Pettersson, incl 3 colleagues	Sweco	Project leader waste water projects
Dick Karlsson	Kretslopp och Vatten	Specialist water
Anna Bodin	Sweco	Project leader waste water projects
Sofia Thorsson	University of Gothenburg	Professor
Caroline Valen	Planning department	Architect and urban planner
Sara Carlsson	Alvrummet / Alvstranden	Host
Poznan		
Włodzimierz Dudlik (**3x**)	Aquanet	Director
Piotr Matczak	Adam Mickiewietz University	Researcher
Zszislaw Cichocki and his team	Institute for Environmnetal Protection	Vice-president office Wroclaw
Wojciech Szymalski	Institute for Sustainable Development	President
Monika Kotynia	Arcadis	Advisor
Bozena Kornatowska	Institute for Environmnetal Protection	Manager
Katarzyna Szmiegel-Rawska	University of Warsaw	Researcher
Presentation + Q&A	Municipality of Poznan	Municipal officials
Expert interview		
Caroline Uittebroek (**2x**)	University Utrecht	researcher
Member checking interviews		
Martijn Steenstra	Sweco NL	Advisor water and enviroment
Zdzislaw and Bozena	Environment protection institute	project leader and project member
Wim Beelen	Municipality of Utrecht	Area manager

Appendix 3 – Interview guide

Each interview was tailor-made for the respondent as they all had different expertise and interest in the project. Therefore they could highlight different aspects of the planning capacities. The list below provides an overview of some general questions.

Legal capacity (policy instrument, environmental equity)

- Which policy instruments are present that relate to climate adaptation?
- What could be beneficial policy instruments for climate adaptation?
- What are the most influential policy instrument for climate adaptation?
- Would it help if policy instrument have a legal basis?
- What is, according to you, the best way to incorporate climate adaptation into existing policies? Hard versus soft regulations?
- What is your expectation regarding the eventual implementation of climate adaptation into the project?
- -To what extent is environmental equity taken into consideration in relation to climate change impacts on social groups?
- Is there data on climate change risks and is it publically assessable?

Institutional capacity (organisational structure, accountability, embeddedness of climate adaptation)

- Can you elaborate on the project structure?
- Is inter-sectoral cooperation required for climate adaptation?
    - How is this organised within the project?
- Is there support from the leadership?
- Is climate change adaptation formally placed under the responsibility of a municipal department or individual?
    - If yes, how is this arranged and does this work in practice?
    - If no, how is this experienced?
- What is your organisation's statement on climate change adaptation?
- How is climate change adaptation framed?

Social capacity (network relatedness, stakeholders and community engagement

- Can you mention some network that are relevant for spatial or adaptation planning?
- Do you benefit from participating in networks? If yes, what?
- Are many stakeholder actively engaged in the project and how?
- Who is involved with spatial and adaptation planning?
- Are their significant differences in the level of engagement between stakeholders?
- Is the community engaged with spatial or adaptation planning?
- Are there any effort to engage the community more?

Resource capacity (economic, human and technical resources)

- How is adaptation planning financed?
- Do you expect bottlenecks for the financing of climate adaptation?
- Is their sufficient knowledge within the project with respect to climate adaptation?
- What kind of knowledge or skills are present or still missing?
- How much assistance is there from external experts and consultants?
- What adaptation solutions are considered? And tested on technical feasibility?

Learning capacity (information resources and collaborative learning)

- Is their sufficient local knowledge regarding climate change and adaptation?
    - Does this account for all climate change themes?
- Do you believe that new knowledge is actively being generated and is it efficiently used?
- Do what exchange does information exchange take place on all governmental levels?
- Are all risks and vulnerabilities mapped in relation to climate change?
- Are there formal or informal that promote learning processes?
- Are there planned evaluation for the spatial or adaptation planning process?

Appendix 4 – Statements member checking interviews

1. Municipalities are the legitimate authority to take the lead in climate change adaptation and national guidance is not necessary in terms of knowledge dissemination, nor financial contributions.

2. Transparency of knowledge and information is of crucial importance to establish a shared understanding among stakeholders of climate change adaptation.

3. To establish support from all stakeholders, climate change adaptation should be framed as an opportunity to enhance the quality of public space rather than a necessity in preventing possible disasters in 40+ years.

4. Having a programme manager climate adaptation planning with its own mandate and budget is a hard prerequisite to effectuate climate adaptation action, because this will not originate itself out of municipal officials or practitioners.

5. Integrating adaptation planning requires a change in the mind-set in the public administration in terms of openness for inter-departmental cooperation.

6. Without a legal basis or institutionalisation of climate change adaptation, it will not be incorporated into urban planning processes or will be discarded easily.