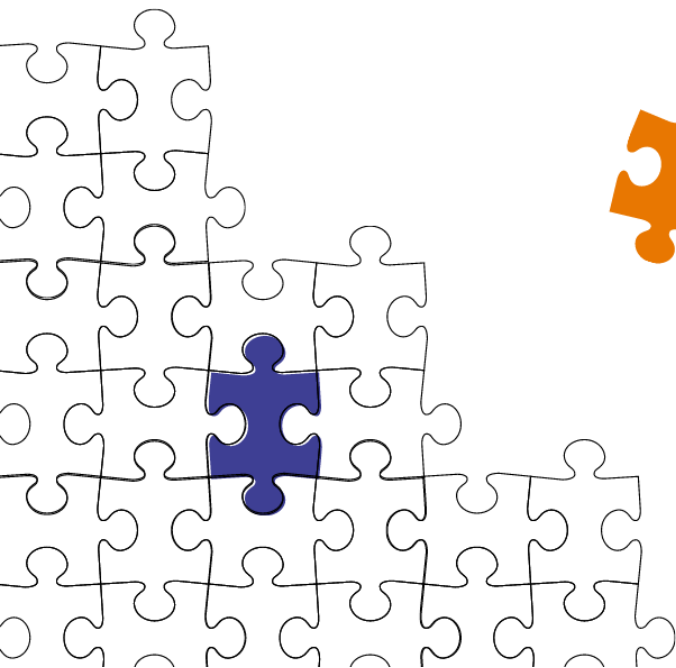


The big puzzle of climate adaptation

Limburgish governments working towards a climate adaptive policy instrument mix



Phebe van Kleef

Master's Thesis for the Spatial Planning
programme, specialisation cities, water
& climate change

Nijmegen School of Management

Radboud University

July, 2022

Colophon

Title: The big puzzle of climate adaptation: Limburgish governments working towards a climate adaptive policy instrument mix

Author: Phebe van Kleef

Student number: S4805631

Submission date: 4th July 2022

University: Radboud University, Nijmegen School of Management

Master: Spatial Planning

Master specialization: Cities, water & climate change

Supervisor: Henk-Jan Kooij

Internship: Province of Limburg

Supervisor: Rien Huisman

Word count: 35.033

Radboud University



provincie limburg



Preface

When explaining my master thesis to future employers, fellow students or friends and family, I prefer to describe climate adaptation as a big puzzle. The puzzle contains the main story of embedding climate adaptation in governmental organizations. Often climate adaptation is seen as a linking opportunity which has to fit into the existing governmental organizations. These governmental organizations are traditionally compartmentalized in domains, departments and sometimes even in a policy and implementation section. This results in climate adaptation being fragmented in different goals, and therefore different pieces of the puzzle, of working towards a climate adaptive environment. These pieces of the puzzle are the subgoals such as drought, water nuisance, flooding and heat stress, that contain different policy instruments for adapting towards these subgoals. This over compartmentalization and fragmentation results in the big picture, an overview, being lost, where this thesis tries to put the different pieces together.

The opportunity to work on the policy instruments within the province of Limburg proved to be a good fit. The helicopter view and strategic thinking of the province firstly helped to identify the pieces of the puzzle; the different goals, policy instruments and actor coalitions. Secondly, the province provided me with plenty of opportunities to discover the current policy arrangement and institutional context. I got to attend several different meetings, was provided with contacts, got feedback on my work and had the opportunity to ask several questions. Therefore I would like to thank my provincial supervisor, Rien Huisman, and all of the co-workers of the nature and water department. Thirdly, I would like to thank all of the respondents from the province, the regions, the municipalities and the water authority for all of their valuable input for this master thesis.

This master thesis also marks the end of my academic career at Radboud University. During these five years I have gained a lot of knowledge and got to explore my intrinsic motivation for my further career. This thesis formed a big inspiration for pursuing a career within sustainable governance. The thesis process has been a challenging, but foremost a useful, learning experience. I would like to thank Henk-Jan Kooij for guiding me through this last period of my master. I am happy to share the end product of my study with you, in forms of this master thesis.

Enjoy reading,

Phebe van Kleef

Summary

Climate change has had several severe consequences in the past and will continue to affect our living environment in the future. A way to reduce these negative impacts is by climate adapting the environment. Climate adaptation can be seen as a public-good topic, as many characteristics connect to the need for collective action. Governments therefore have an important role in climate adapting the living environment to prevent future damage by more extreme weather events. In order to achieve a climate adaptive environment, governments first create strategies followed by actions and measures. Policy instrument instruments can be perceived as the actions governments take to implement climate adaptation.

Policy instruments are applied within a policy arrangement, which describes the current institutional context concerning the actors, the resources, the discourse and the rules of the game. This policy arrangement has an influence on the policy instruments, which can be conceptualized within several factors. This alignment can explain the limitations within the policy instrument mix. Within this research the underlying factors are therefore retrieved from the data to gain a better understanding of the patterns that lead to the current policy instrument mix.

Next to these underlying factors the policy instrument mix within climate adaptation has been analyzed. A policy instrument mix contains several different policy instruments. These instruments can either be effective and work towards creating a climate adaptive environment, or can be counterproductive and produce little to no change. Therefore an efficient policy instrument mix is necessary to achieve a climate adaptive environment and recommendations could improve the policy instrument mix.

The case of Limburg has been chosen to examine the policy arrangement, its instruments and the instrument mix. Climate adaptation is a subject that mostly gets implemented on a regional scale, and because of the recent flood event, the case of Limburg proved to be an interesting case to examine what policy instrument mix is currently implemented to adapt to the climate. A survey has been conducted to generate an overview of the instruments. The more complex alignment between the policy arrangement and the instruments, and the instrument mix itself, got researched via a case study. The three regional governmental levels served as the cases (province, water authority, municipalities). In addition, the process coordinators of the regions were added to represent the four regions in Limburg working on climate adaptation.

Several factors were found to be influencing the policy instrument mix. The most important ones being the water related discourse, the fragmentation of climate adaptation, the lock-in financial situation and the lack of rules and regulation. This has, for example, caused climate adaptation to be organized within the water domain, has caused a widespread overstructured actor coalition and financial system, slows down the process of implementation by high investment costs, and causes project developers being able to not include climate adaptive building in the built area.

Finally, the current policy instrument mix is mostly water related and fragmented, where budgets are allocated to separate goals and therefore budget synergies causes excessive administrative procedures. Secondly, a broad topic such as climate adaptation does not seem to fit in the current compartmentalized governmental system and therefore additional organizational instruments are deemed necessary. Lastly, the policy mix contains little structure and regulation. Therefore prevention of non-climate adaptive activities are hard to ensure. In order to create an all-encompassing policy instrument mix the connection with heat stress and other linking opportunities should be made, and instead of mainly focusing on the treatment of symptoms, prevention of future non-climate adaptive actions has to be embedded in provincial and municipal regulation.

List of tables and figures

Table 1: Operationalization of policy instruments, Henstra (2016)	22
Table 2: Operationalization theories	23
Table 3: Case selection	27
Table 4: Interviews municipalities	30
Table 5: Interviews regional coordinators.....	30
Table 6: Interviews water authority	30
Table 7: Interviews province of Limburg	31
Table 8: Observations.....	32
Table 9: Factors of alignment	48
Table 10: Information and communication instruments	70
Table 11: Organizational instruments	71
Table 12: Economic Instruments.....	73
Table 13: Legal instruments	75
Figure 1: Policy arrangement approach, Arts et al. (2006)	16
Figure 2: Stages of the policy process, Moser & Ekstrom (2010).....	19
Figure 3: Conceptual framework (own work)	22
Figure 4: Landscape types, Province of Limburg 2021	24
Figure 5: Climate adaptation regions (CBS, 2021).....	24
Figure 6: Map of participating municipalities (own work)	32
Figure 7: Most relevant actors in climate adaptation (own work).....	38
Figure 8: Stress test drought Waterpanel Noord (n.d.)	45
Figure 9: Route risk dialogues, Klimaatadaptatieportaal (n.d.)	46
Figure 10: One million tree plan, Roumen (2021).....	58
Figure 11: Partly DHZ funded restructuring in Bocholtz, VZP advies (2021)	59
Figure 12: Disconnection from the sewage in Weert, Heerlijk Weert (n.d.).....	60

Frequently used abbreviations

DPRA	Delta Plan Spatial Adaptation
DHZ	Delta Plan High Sandgrounds
HWBP	High Water Protection Program
POP-3	Rural Development Program
AKAL	Civil Climate Adaptation Coalition Limburg
BKAL	Administrative Climate Adaptation Coalition Limburg
WBL	Water company Limburg
WML	Water supply company Limburg

Table of contents

Preface.....	3
Summary	4
List of tables and figures.....	5
1. Introduction.....	8
1.1 Problem statement.....	8
1.2 Research aim	9
1.3 Research questions.....	9
1.4 Relevance	10
1.4.1 Scientific relevance.....	10
1.4.2 Societal relevance.....	11
1.5 Reading guide	11
2. Theoretical framework.....	12
2.1 Climate adaptation.....	12
2.1.1 Climate adaptation measures	13
2.2 Governance	14
2.2.1 Governance of climate adaptation.....	14
2.2.2 Governance: top down or bottom up	14
2.3 Multi-level governance.....	15
2.5 Policy arrangement	16
2.5.1 Operationalization.....	17
2.6 Climate adaptation policy instruments	18
2.6.1 Policy process	18
2.6.2 Policy instruments	19
2.6.3 Operationalization.....	20
2.7 Conceptual model	22
2.8 Operationalization.....	23
3. Province of Limburg.....	24
3.1 Regions	24
4. Methodology	25
4.1 Research philosophy	25
4.2 Research strategy	26
4.2.1 Case study.....	26
4.2.2 Survey.....	27
4.3 Research method and data collection.....	28
4.3.1 Interviews	28

4.3.2 Observations.....	31
4.3.3 Survey.....	32
4.4 Data analysis.....	33
4.5 Validity and reliability.....	33
5. Results.....	35
5.1 Policy arrangement.....	35
5.1.1 Discourse.....	35
5.1.2 Actors.....	38
5.1.3 Resources.....	41
5.1.4 Rules of the game.....	45
5.2 Alignment between the policy arrangement and the policy instruments.....	48
5.3 Policy instruments.....	49
5.3.1 Information and communication instruments.....	49
5.3.2 Organizational instruments.....	53
5.3.3 Economic instruments.....	56
5.3.4 Legal instruments.....	64
5.4 Current policy instrument mix.....	69
6. Conclusion.....	76
7. Discussion.....	82
7.1 Reflection on theory.....	82
7.2 Reflection on methodology.....	83
7.3 Recommendations for praxis.....	83
8. References.....	85
Appendix.....	89
Appendix A Overview data collection.....	89
Appendix B Conclusion provincial report.....	91
Appendix C Operationalization climate adaptive instruments.....	92
Appendix D Survey questions.....	95
Appendix E Survey data.....	99
Appendix F Interview guides.....	102
Appendix G Code scheme.....	108

1. Introduction

1.1 Problem statement

Recent events in the province of Limburg have made it inevitably clear that the climate is changing. The climate in Limburg has seen more extremes than other parts of the Netherlands. Limburg has experienced five flood events in the last ten years and dealt with major drought problems from 2018 until 2020. This trend will continue and more extreme weather will become more regular, with short and heavy showers of more than 50mm per hour, long lasting periods of rain with precipitation of more than 200mm within the timespan of days, periods where the temperature will be higher than 40 degrees and summer months with hardly any rain at all (Waterschap Limburg, 2021). This can result in various negative effects, such as the sinking of the groundwater level to a record breaking low point, causing economical damage for farmers. The flooding of last summer that caused major economic damage and the evacuation of thousands of households and the wildfires in nature areas causing damage to the ecosystem (world weather attribution, 2021). Climate adaptation is, next to climate mitigation and geo-engineering, a way to cope with climate change and to deal with these negative effects. Where climate mitigation and geo-engineering try to reduce further climate change, climate adaptation focusses on limiting the consequences of climate change (Füssel, 2007).

Governments have an important role to climate adapt the environment and prepare for these more regular extreme weather events. Many aspects of climate adaptation have public-good characteristics which require collective action (Termeer et al., 2011). Climate adaptation is a subject which predominantly gets implemented on a regional scale, as the variety of local and regional conditions and climate impacts require different reactions and measures. Regional governments focus on developing and realizing policies that minimize the potential damage at a regional level and that cope with the specific regional climate impacts (Termeer et al., 2011). Therefore the regional governments will be the scope of this thesis, which consists of the province of Limburg, the water authority Limburg and the municipalities.

These regional governments develop climate adaptive policy which later results into the use of policy instruments (Henstra, 2016). Policy instruments can be perceived as the measures the governments take to put their climate adaptive plans into action (Mees et al., 2014). Policy instruments have been an important subject of research. It can be argued that an instrument-based approach better clarifies the nature of policy dynamics, and support policymakers in taking more effective decisions, than a purely input-based approach (Capano & Howlett, 2020).

In policy domains sets of policy instruments are implemented which have a mixed nature and feature different patterns and trajectories which change over time. Therefore, the policy instrument approach can be better applied when linking it to studies of governance and policy (Capano & Howlett, 2020). There is a current research lacuna to disentangle how different factors drive the design of efficient or non-efficient policy mixes (Capano & Howlett, 2020). Therefore, within this thesis, the policy arrangement will be aligned to the policy instrument mix to discover the underlying patterns and factors that influence the current policy instrument mix.

In addition, policy instruments are commonly deployed in a mix which creates interactive effects among them. These effects can be complementary or supplementary, but can also feature counterproductive effects among policy instruments as well as synergies when multiple tools are deployed together (Capano & Howlett, 2020). Tools in an instrument mix can be considered complementary when they work together to support a policy strategy, such as a climate adaptive environment. There is a wide consensus in the policy design literature that not all tools are designed entirely complementary and that some generate counterproductive responses in policy goals. A key

principle of current policy design thinking is, therefore, to maximize complementary effects and minimize conflicting ones (Capano & Howlett, 2020). Within scientific literature there is a need to understand whether and how the interaction between goals and instruments and different policy mixes operates in different policy sectors and countries (Capano & Howlett, 2020). Therefore the second part of the thesis will focus on the policy instrument mix itself and the improvements that can be made within this mix.

Currently, the climate adaptive instrument mix in Limburg has not yet been analyzed in its entirety and because of the fragmentation within climate adaptive governance the overall overview is lost (Personal communication, 2021). An analysis of the complete mix is necessary to regain an overview of the complete policy instrument mix and discover the constraints, improvements and patterns within this policy instrument mix. This will form the base for the recommendations which could contribute to more efficient policy instrument usage in Limburg and add to the empirical knowledge gaps argued above.

1.2 Research aim

The main aim of this research is to examine the current Limburgish policy instrument mix in climate adaptation, to discover its patterns and improvements, and to contribute to closing some of the knowledge lacunas within policy instrument research. This will be achieved by, firstly, discovering the current policy arrangement containing the discourses, actors, resources and rules of the game. The policy arrangement provides the underlying factors and patterns which align with the climate adaptive policy instruments and will be included within the research. Secondly, this research aims to create an overview of the current climate adaptive policy instrument mix. This policy arrangement is highly complex and fragmented and therefore many governments have lost an overview of what is currently being implemented for climate adaptation (Personal communication, 2021). This will result in a recommendation for governments to understand which policy instruments are used, which ones are or are not functioning well, and which policy instruments are perceived as missing.

1.3 Research questions

This thesis aims to answer the following main research question:

How are climate adaptive policy instruments being used by Limburgish governments and which constraints does this policy mix have?

This main research question will be answered by the following sub-research questions:

- What is the current policy arrangement within climate adaptation in the province of Limburg?
- How does the policy arrangement align to the policy instruments?
- What climate adaptive policy instruments are being used by Limburgish governments and which climate adaptive policy instruments are missing or malfunctioning?

These research questions have been chosen, firstly, to capture the institutional context within the first sub-research question. Secondly, the alignment discovers the underlying patterns and factors within the second research question. Thirdly, the last research question includes the analyzation of the current instrument mix and creates societal relevance by providing recommendations for malfunctioning policy instruments and missing policy instruments which can be replaced, added or improved. These three questions can all be captured within the main research question.

1.4 Relevance

What is researched and reported has to be relevant for users, co-researchers or practitioners in the field (Vennix, 2012). Therefore a research should make a relevant and useful contribution to existing knowledge. This can be divided in scientific and societal relevance.

1.4.1 Scientific relevance

Policy instruments are a scientifically relevant subject as their analyzation helps researchers understand how and why policy dynamics develop, how and why governance modes change over time, and how policy actors accumulate around specific policy instruments (Acciai & Capano, 2020). A substantial body of literature exists concerning the emergence of climate adaptation on local policy agendas, and how political, economic and social factors facilitate or constrain policy adoption (Reckien, 2015; Hughes, 2017). There is less knowledge about how individual policies are accumulating over time into different policy mixes and what factors explain these patterns across contexts. Instrument mixes refer to bundles of individual policy instruments that governments adopt in response to a particular policy problem such as climate adaptation (Lesnikowski, Biesbroek, Ford & Berrang-Ford, 2021). This thesis aims to contribute to discovering the factors causing the emergence of the current policy instrument mix by aligning the policy arrangement theory, to understand the current institutional context, with the policy instrument mix within Limburg. Therefore a deeper understanding of the development of the current policy mix will be provided.

Secondly, within the policy instrument mix there is a scientific need to understand whether and how the interaction between goals and instruments, within existing instruments as well as new instruments, of different policy mixes operate in different policy sectors and countries. Consequently, more empirical research on the effects of the level of coherence, consistency, and congruency on the output and the outcomes of policy tool deployment would contribute to the relatively limited empirical body of policy instrument research (Capano & Howlett, 2020). Therefore this thesis aims to analyze the overall policy instrument mix and the individual policy instruments within the province of Limburg to contribute to this understanding.

In addition, the process of selecting policy instruments depends on the resources and capacities at the disposal of governments. Regarding resources, literature often uses four main categories; nodality (information instruments), authority (legal instruments), funding (economical instruments) and organization. There is an empirical knowledge lacuna on evidence whether and how the characteristics of the actual stock of resources and capabilities at governments' disposal influences the choice of policy instruments and eventually their implementation (Capano & Howlett, 2020). As this research aims to combine the policy arrangement, which includes the resource category, with the policy instruments this influence and alignment can contribute to this empirical knowledge gap.

Finally, policymaking very often has a multilevel governance arrangement, which also forms the scope of this research. Climate adaptation is a cogoverned policy area by local, provincial, national, or international orders of government. Different levels of government are likely to have some common, but also some different, goals and instrument preferences and reconciling them involves the intragovernmental or intergovernmental bargaining and decision-making which may or may not lead to efficient or effective instrument choices and policy designs (Capano & Howlett, 2020). The design of multi-level governance arrangements are crucial, but how these arrangements impact instrument choices and system selection remains to be understood. For example, multi-level governance arrangements can be highly vertical wherein higher levels can impose the instruments to be adopted by lower level governments. However, their effectiveness is reliant on the implementation styles of the lower level governments. These kind of processes are not well

understood (Capano & Howlett, 2020). As this thesis is focusing on the three local governmental levels it partly contributes to the understanding of how higher level governments, such as the province, have an impact on the local and municipal level of policy instrument usage.

1.4.2 Societal relevance

As noted in the problem statement, climate change has had several severe consequences in the past and will continue to affect the living environment in the future. Extreme weather events have caused severe discomfort and damage for the people that live in climate prone areas in Limburg (Waterschap Limburg, 2021). Because of these events climate adaptation has gained a lot of urgency within the province of Limburg. Policy instruments can be used to reach the goal of creating a climate robust environment (Mees et al., 2014). An effective policy instrument mix will result in achieving this goal faster and more efficiently. Therefore research is necessary whether the current policy instrument mix is functioning well or if obstacles in the policy instrument mix emerge, which will be a prominent focus of this thesis.

Secondly, climate adaptation is a complex and fragmented policy arrangement. The fragmentation of the topic into different departments within the different governments has caused a lack of overview within the policy instrument mix (Personal communication, 2021). Therefore this research will help the province of Limburg to create an overview of the policy instruments and form a base of knowledge about what instruments are currently in use. In addition, this research will form recommendations how the policy instrument mix can be improved. Malfunctioning policy instruments and missing policy instruments can therefore be replaced, added or improved. Consequently, these recommendations could contribute to more efficient instrument usage and identify future possible climate adaptation instruments.

1.5 Reading guide

The subsequent chapters of this thesis will consist of the theoretical framework providing the theoretical background for this research. This theoretical framework will provide the operationalizations of the policy arrangement and the policy instruments, which have been applied to the case of Limburg. A description of the important regional water cooperation's will be included in the third chapter. The fourth chapter will consist of the methodological choices enhancing on the choice for a case study and a supporting survey. The fifth chapter will include the results and analysis of the policy arrangement, the policy instruments and the aligning between the arrangement and the instruments. Next to these results an overview of the contributing factors of the policy arrangement will be summarized in paragraph 5.2. Following with a complete overview of the individual policy instruments, the recommendations and the missing instruments in paragraph 5.4. The conclusion to the main and sub research questions will be drafted in chapter six. Finally, the last chapter will reflect on the theory and the methodology and will form recommendations for praxis and future research.

2. Theoretical framework

This chapter contains an overview of the relevant scientific literature. In order to achieve an objective answer to the research questions scientific literature has been used to explain the main concepts and theoretical background within this thesis. The first paragraph will contain the context of climate change and climate adaptation to gain an understanding of the policy domain. To introduce the governance within this policy field the different views about governance will be elaborated on, including the multi-level governance approach. This will serve as background information on the different styles of governing and how this policy field is interconnected within all of the governmental levels.

The two main theories which will be applied in practice are the policy arrangement and the policy instrument theories. The literature outlines the policy arrangement approach, which is a temporary freezing of the policy domain, and provides the tools to measure the institutional context within the province of Limburg. Finally, within the policy arrangement certain policy instruments emerge and are used to implement climate adaptation. The theoretical background about policy instruments will be the last part of the theoretical framework. The chapter will be concluded with the conceptual model and the operationalization.

2.1 Climate adaptation

Climate change is associated with substantial risks for society and nature. Society can respond in three ways to reduce these risks of climate change, which are climate mitigation, geo-engineering and climate adaptation. Climate mitigation entails on limiting the global climate change by reducing the emissions of greenhouse gases or enhancing their sinks (Füssel, 2007). Geo-engineering refers to technologies that aim to make large-scale and deliberate interventions in the climate system possible. It is typically referred to by researches as a Plan B, in case mitigation fails to avert dangerous climate change (Corry, 2017). Climate adaptation refers to the responding to the actual or expected climate change to reduce harm and damage to the vulnerable areas (Füssel, 2007).

Climate adaptation can generally be defined as: *“Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities”* (IPCC, 2018, p. 542). This definition emphasizes the broadness of the topic and thus integrates climate adaptation with other fields, such as land-use plan updates, infrastructure replacement or the renovation of buildings.

Climate adaptation is a subject that is getting more and more political attention. The greenhouse gas and aerosol emissions are already affecting average climate conditions and cause climate extremes. In the last twenty years society has experienced some of the warmest years globally. Climate change has had substantial impacts on many natural and social systems and the climate will continue to change for the foreseeable future (Füssel, 2007). The effect of reducing emissions will take at least several decades to become fully apparent and noticeable. Whereas in the meantime most climate adaptation measures have a shorter lead time and could be implemented already to reduce future and current risks and damage. As the efficacy of climate adaptation measures is less dependent on the actions of others, such as surrounding governments, it is important that climate adaptation measures are implemented at a local or regional scale (Füssel, 2007).

Adaptation to climate change is not a well-defined and delimited set of actions. Adaptation is different for every regional and local situation. It will depend on which climate-sensitive domains are present within the region, such as: agriculture, forestry, water management, coastal protection, public health and disaster prevention. In addition, it will also depend on the types of climate hazards, which refers to the observed and expected changes in average climate, the climate variability and the

climate extremes (Füssel, 2007). Adaptation to the climate involves both infrastructural and technical adjustments, such as dyke reinforcements or creating water-storage capacity, and broader processes of societal change, such as spatial planning, more efficient water use or agricultural transitions (Termeer et al., 2011).

Many aspects of adaptation have public-good characteristics and require collective action. Most people in the Netherlands expect governments to safeguard them from the impacts of climate change (Termeer et al., 2011). The national government has chosen to define climate adaptation within four main topics: heat stress, drought, flooding and water nuisance. In the Netherlands the Delta Plan and the National Adaptation Strategy (NAS) are the main strategies used to work towards a climate adaptive environment. The NAS is complementary to the Delta Plan. Both entail on the concept of climate adaptation and how the environment should be adapted for the observed and future climate change (IenW, LNV & BZK, 2020). This will be implemented in the following climate-sensitive domains: water, agriculture, nature, built environment, infrastructure and health.

The Delta program set the goal that the Netherlands will have to be water robust and climate proof by 2050. They plan to achieve this goal by preventing water damage, heat stress, droughts and the limitation of the consequences in the event of flooding through spatial planning measures (IenW, LNV & BZK, 2020). This will be done by working together with provinces, municipalities and local water authorities. These local authorities will get the opportunity to perform a stress test, followed by a risk dialogue, to map the prone areas, and eventually will have to translate this information into an implementation program. Secondly, water robust and climate proof spatial planning has to be embedded in the policy and actions of all the governmental bodies, whereafter it will become part of all the spatial planning activities (IenW, LNV & BZK, 2020).

The regional scale will be the main context of this research. Whereas climate mitigation can have global effects by reducing the greenhouse gasses, climate adaptation predominantly leads to regional effects. Therefore there is less of a chance of free riding within climate adaptation. This makes it extremely relevant that each region ensures climate-proof spatial planning and climate adaptation, as the regional governments will mostly benefit from adaptive measures within their own province or municipality (Termeer et al., 2011).

2.1.1 Climate adaptation measures

There is a multitude of measures regional governments could implement for climate adaptation. Each region is different, has different soils, weather conditions, weak spots and political discourses, emphasizing the most optimal or effective measures will differ in each province and municipality (Termeer et al., 2011).

Overall the measures governments can implement to work on climate adaptation can be divided in two categories. Runhaar et al. (2012) divide these measures into drought (which includes heat stress) and flooding (which includes water nuisance), as these two topics are considered the main challenges in the light of climate change. Measures for drought and heat stress could be to insulate buildings, install cooling systems, sun screens, building orientation or installing green roofs or green facades. Measures for flooding could be the destoning of gardens, river flooding insurance, water permeable pavement instead of asphalt, separation of rainwater and sewage water, enhancing capacity of sluices and weirs or additional / reinforcing flood defenses such as dykes (Runhaar et al., 2012). The measures can also be divided by technical, more traditional and infrastructural measures, which tends to assume that a government is responsible for implementing technological adaptation measures (dams, irrigation schemes etc.), and non-technical measures such as spatial planning,

incorporating green blue infrastructure or encouraging citizens to take measures (Klein, 2011; Begg, 2018).

2.2 Governance

2.2.1 Governance of climate adaptation

Climate adaptation is not only a technical or measure related issue. It is above all a matter of governance. Governance entails more than government, as it includes the totality of interactions in which public as well as private actors participate, aiming to solve societal problems such as climate change (Termeer et al., 2017). Climate adaptation governance includes some specific, demanding challenges, such as the context of institutional fragmentation. Climate change and climate adaptation involves almost all policy domains and governmental levels which causes this policy domains' fragmentation. In addition, key features of climate adaptive governance are the persistent uncertainties about the nature, the scale of risks and proposed solutions. This results in governments having to make short-term policies based on long term projections. Finally, climate adaptation is an emerging policy field with currently weakly defined ambitions, procedures, responsibilities, routines and solutions (Termeer et al, 2017).

Therefore climate change impacts upon a variety of physical and social systems that are heavily interconnected. This means that the governance system has to deal with the consequences of climate change in even a more fragmented manner than their counterparts in other policy domains (Termeer et al., 2011). Climate adaptation affects various domains such as water management, spatial planning, infrastructure, agriculture, forestry, energy supply, nature, industry and health. These domains are all related to different policy sectors, policy systems and administrative levels. These are, in turn, characterized by formal and informal rules, problem framing, ambitions and resources and creates new interdependencies amongst these domains, actors and governmental levels (Termeer et al., 2011).

This is why the governance of climate adaptation can be defined as a wicked problem. Wicked problems are unstructured problems which are difficult or impossible to solve due to incomplete, contradictory, and changing conditions. Wicked problems are often difficult to identify, therefore the formulation of a wicked problem is the problem. Disagreement on goals and facts makes climate adaptation prone to debates that inevitably result in power plays (Termeer et al, 2017). In addition, wicked problems have no stopping rule and are continuous processes, meaning the problem of adaptation to climate change can never be resolved definitively and actors can always try to do better. The benefits of adaptation measures can take a considerable amount of time to become evident and it is also hard for actors to assess how much adaptation is enough for future weather circumstances (Termeer et al., 2017). Therefore governing climate adaptation is a complex task with no easy upfront solutions.

2.2.2 Governance: top down or bottom up

As elaborated before, climate adaptation mostly focuses on local and regional responses. Regional governance focusses on developing and implementing policies that minimize the potential damage at the regional level and deals with the specific regional climate impact (Termeer et al., 2011). Regional refers to the subnational level, which can vary from the level of neighborhoods up to the level of provinces. Important actors that play a role within these regional governance structures are municipalities, water authorities, provinces, regional interest organizations and housing corporations. However, even though much of climate adaptation gets implemented at the regional level, this does not exclude the national and European actors. These two actors often provide an important fiscal and regulative context for the regional governance (Termeer et al., 2011).

This enhances on the discussion if climate adaptation should be governed top down or bottom up. In the Netherlands multi-level governance has been part of the governmental culture for decades. Sometimes this is seen as a negative in terms of bureaucracy, administrative burdens, fragmentation and conflicts over the division of roles (Termeer et al., 2011). A top down approach would result in a radical reduction of complexity and one central climate-adaptation policy approach, such as a climate act or climate director, could be preferred for a quick and easy way to govern. The main argument for a top down approach is that fragmented lower level governance structures will never be able to provide the capacity required to tackle an issue which is as important as climate change (Termeer et al., 2011).

There are also reasons to doubt a top down steering model. The shift from government to governance led in a new discourse that we must let go of the image and idea of a malleable society steered by a central government. Governance is a more horizontal approach, in which policy is formulated and implemented in cooperation with various public and private parties (Van Buuren, Edelenbos, & Klijn, 2010). This creates self-organizing inter-organizational (policy) networks that can deliver and produce public goods and services. Governance implies that governments need to work differently which refers to multiple mutually dependent actors having to contribute collectively to the policy process and multiple processes influence policy developments (Osborne, 2006).

2.3 Multi-level governance

Multi-level governance can be defined as: *“The political structures and processes that transgress the borders of administrative jurisdictions, aiming to cope with interdependencies in societal development and political decision-making which exist amongst territorial units”* (Benz, 2006, p. 95). Multi-level governance implies a change in the processes of interaction between different political actors and levels in such a way that multi-level policy networks have a position of their own (Eckerberg & Joas, 2004).

Multi-level governance is particularly relevant in the context of climate adaptation. Climate adaptation is an interwoven subject between various administrative levels making governmental levels dependent on one another. Multi-level governance can anticipate on the unexpected outcomes of climate change and create space for variability and learning from a bottom up polycentric system. Consequently, a multi-level and more horizontal governance forms the inescapable context for climate adaptation because the effects of climate adaptation stretch across different policy domains and institutional levels (Termeer et al., 2011).

Climate adaptation has evolved into a highly complex polycentric structure that spans from global, European and national levels to the more local, levels such as provinces and regions. These rely on both formal and informal networks and policy channels which are mutually dependent on one another. These multi-level governance arrangements are involved in formulating and implementing climate adaptive policies and policy instruments (Di Gregorio et al., 2019). Therefore climate adaptation in the province of Limburg can be identified as a multi-level governance arrangement, as all three governmental levels are involved in climate adaptation and get influenced by the national government.

The multi-level governance arrangement in Limburg consists of the province, the four climate adaptive regions, the water authority and the municipalities. The national government has produced three major policy documents: the National Adaptation Strategy, the Delta Plan (including funding) and the national environmental vision which provide frames for climate adaptation. These strategies have to be taken into account by the lower level governments. The province and the water authority mainly involved climate adaptation in their water programs. The regional actors include climate

adaptation by creating regional climate adaptation implementation plans (Uitvoeringsagenda Maas- en Merland, 2021). The lowest governmental level are the municipalities, who create their own local adaptation agendas, environmental visions, zoning plans and sewage plans. All of the governmental levels are included in governing climate adaptation. Therefore the multi-level governance perspective forms the institutional context in which the policy arrangement of the province of Limburg is situated.

2.5 Policy arrangement

This multi-level governance arrangement can be conceptualized by the policy arrangement approach. Policy arrangements can be defined as the temporary stabilization of the content and organization of a policy domain. Policy arrangements refer to political modernization in the form of the shift of responsibilities from government to governance and the related processes of institutionalization in policy domains (Arts, Leroy, van Tatenhove, 2006). Organizations, such as governments, social organizations or companies, conquer a position, develop characteristic manners and rules of conduct, and transfer visions and opinions to each other. Certain practices, habits, visions and opinions within a policy domain have become 'institutionalized', 'patterned' and 'integrated' in everyday policy practice (Wiering & Immink 2009). Sometimes these patterns and visions are laid down in formal rules (procedures, substantive norms, etc.), sometimes they are institutionalized in a more informal manner, which includes informal, interaction rules or political 'rules of the game'. At the same time, a policy domain is constantly changing and dynamic. Existing policy arrangements can be typified according to the sectoral classification of policy domains (water, spatial planning, agriculture, environment, nature). Traditional, strongly integrated patterns of thinking and acting often play an influential role here. Other, more topic-specific or area-specific policy arrangements can also arise, such as climate adaptation. What kind of policy arrangement emerges cannot be determined in advance (Wiering & Immink, 2009).

The policy arrangement approach can be divided in the following four categories (Arts et al., 2006):

- The *actors* and the actor coalitions involved in the policy domain.
- The division of power and influence between these actors. Power refers to the ability of actors to mobilize, divide and deploy *resources* and the influence of who determines policy outcomes and how.
- The current active *rules of the game* within the arrangement in terms of actual rules for political and other forms of interaction, but as well in terms of formal procedures in pursuit of policy and decision-making.
- The dominant policy *discourses* and programs. A discourse refers to the views and narratives of the actors involved: in terms of norms and values, definitions of problems and approaches to solutions. Programs refer to the specific context of policy documents and measures.

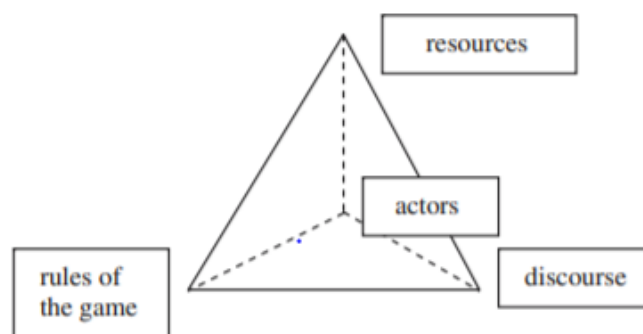


Figure 1: Policy arrangement approach, Arts et al. (2006)

Figure 1 presents the schematic visualization of the policy arrangement and shows the dimensions that form a policy arrangement. The four analytically distinguishable dimensions are inseparably linked (Arts & Leroy, 2003). The interconnectedness between the dimensions is represented by the lines connecting the corners of the tetrahedron. These connections mean that change in one (or more) of the dimensions of a policy domain can cause a change in the entire policy arrangement and therefore influences the nature of the entire policy arrangement (Arts, Leroy & Van Tatenhove, 2006). The policy arrangement approach provides the tools and categories to measure the institutional context which is necessary to align with the policy instruments.

2.5.1 Operationalization

In order to use the theoretical concepts from the policy arrangements approach in empirical research, the concepts need to be operationalized.

Actors

The actor dimension of the policy arrangement approach provides insight into which actors are involved within a policy domain. Actors can be described as coalitions and oppositions of individuals, groups and organizations that are involved in the decision-making and implementation around a policy theme. Actors are often part of coalitions and oppositions which aim to achieve the same goals. Coalitions and oppositions are often formed by actors who use the same interpretative frameworks and can arise because they call upon the same resources or apply the same rules (Wiering & Arts, 2006). The actors in a policy domain can be, for example, national governments, the EU, municipalities or businesses. A coalition consists of more than one actor and emerges when actors want to achieve shared objectives by allocating resources in a certain way and agreeing on rules of the game (van Tatenhove, Arts & Leroy, 2000). Therefore the actor dimension will use the following indicators; which actors are involved in climate adaptation, which actor coalitions exist, and what the collective goal of these coalitions entail. Another indicator included in this section is how the roles are divided between the actors. When an actor has a leading role it is important for the setting of broad objectives, providing policy direction or funding (Mintrom & Norman, 2009).

Resources

The second dimension of the policy arrangement are the resources and the influence which could be used to achieve the policy goals. Resources can be defined as the means that actors have at their disposal or can mobilize to realize ambitions (Veenman, Liefferink & Arts, 2009). These include financial resources, human capacity and knowledge and expertise. Although actors can mobilize resources to achieve policy goals, resources are not equally allocated among actors. Not all actors have the same access to resources, and the actors involved depend to varying degrees on each other's resources (Veenman, Liefferink & Arts, 2009). The distribution of resources between actors therefore determines the balance of power in a policy arrangement (Arts & Leroy, 2006). Some actors have a certain influence with their power to shape resources to their liking and thus determine policy outcomes and block goals of other actors (Arts & Leroy, 2003). The unequal distribution of resources between actors therefore leads to situations in policy practice where not all actors have the same capacities to achieve (policy) goals (Wiering & Arts, 2006). Therefore this thesis will focus on how resources are distributed in the policy domain, within the financial, knowledge and human capacity.

Rules of the game

The third dimension focusses on the rules of the game. Giddens (1984) defines rules of the game as the 'externally' determined characteristics of the content and organization of the policy. In other words, the legislation, procedures and political culture that are relevant to a particular policy domain. According to Giddens (1984), laws and regulations can be of a substantive and

organizational nature. The substantive rules of play determine the legal frameworks in which the actors can maneuver (Veenman, Liefferink & Arts, 2009). The indicator legislation is aimed at providing insight into the substantive procedures and rules that apply in a policy domain. Procedures are the decision making processes that get summarized into a rule (Wiering & Arts, 2006). These rules set the legal context, or the political culture, in which an actor can or cannot have a say in policy making (Giddens, 1984). In this thesis, the political culture and the legislation indicators are used to examine which laws, regulations and procedures apply to climate adaptation policy, which are the formal rules, and informal agreements that have been made, referring to informal procedures (Mattijssen et al, 2015).

Discourse

The term discourse refers to the content of the policy and the way in which actors give meaning to that content. Mattijssen et al. (2015, p.23) define discourses as; *“specific sets of ideas, concepts and categorizations that are produced, reproduced and transformed in a particular set of practices and through which meaning is given to social and physical realities”*. In other words, this dimension is referring to the narratives and visions of actors, how these are constructed and how this is embedded in social and institutional practices (Mattijssen et al., 2015). Discourses can include problem definitions of social and political topics (van Tatenhove, 2017). Discourses can as well refer the articulation of a cause, a possible solution (a policy program or strategy) and a concrete goal (Liefferink, 2006). According to van Tatenhove (2017), a dominant discourse can structure the rules and resources in the climate adaptation policy arrangement. However, an alternative discourse can challenge and eventually replace the dominant one, which can cause new coalitions, rules and resources, and therefore institutionalization of an alternative policy arrangement emerges (van Tatenhove, 2017). Overall there are three types of discourses: discourses in which statements are made about reality (ontological), discourses that reflect statements about desirability (normative) and discourses that indicate possibilities for moving from reality to desirability (the strategy or route) which will be used as the indicators in this category (Wiering & Immink, 2009).

2.6 Climate adaptation policy instruments

To implement climate adaptation policy instruments are necessary. Different policy instruments can be used at different stages within the policy process. It is important to investigate the patterns within the policy arrangement, where the shortcomings appear, and what instruments the governments eventually implement.

2.6.1 Policy process

The policy process of getting to the point of implementation of policy instruments contains a few phases. In between these phases barriers can arise and hinder progress from one stage to another. Understanding is the first phase in the policy process, which contains the problem detection and awareness raising, resulting in an initial problem framing (Moser & Ekstrom, 2010). This is followed by the information gathering to deepen the problem understanding and the problem (re)definition which results in framing that does or does not warrant further attention to the issue. The second stage, planning, involves the development of adaptation options, the assessment of these options and the selection of the option(s). The last phase, the management phase, refers to the implementation of the selected option(s), monitoring the environment and outcome of the realized option(s); and the evaluation (Moser & Ekstrom, 2010). However in reality this process could be less linear and neat, but the process stages provide a useful ordering heuristic to place the province and the municipalities within as each phase will need different policy instruments.

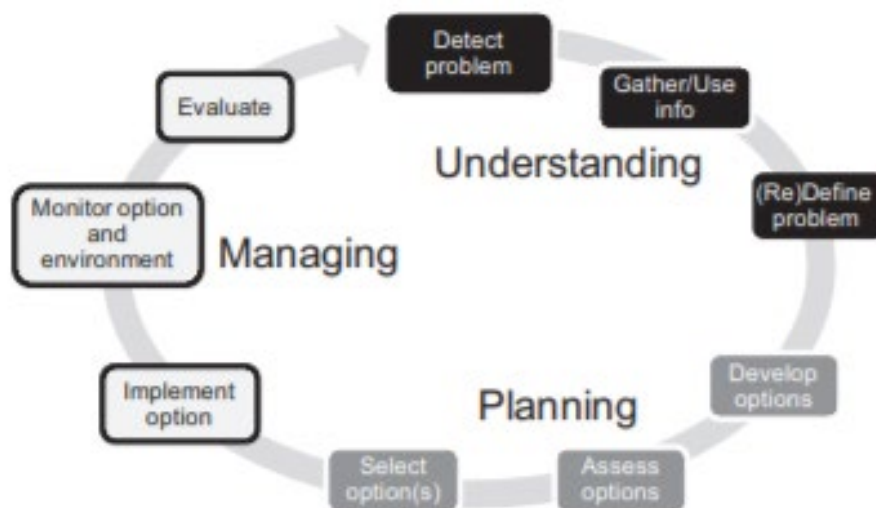


Figure 2: Stages of the policy process, Moser & Ekstrom (2010)

2.6.2 Policy instruments

The policy arrangement provides certain instruments or tools governments can use to achieve their climate adaptation goals. The selection of policy instruments are a crucial element to influence the behavior of actors (Termeer et al., 2017). Burkas & Sallnas (2012, p. 605) define policy instruments as: *“a deliberate and structured effort by governors to solve a policy problem by modifying actions of the governed”*. Therefore policy instruments can be perceived as the measures the province of Limburg, the water authority Limburg and the municipalities take to put their adaptation plans into actions (Mees et al., 2014). The literature usually distinguishes four types of policy instruments: legal instruments, economic instruments, and informative and communicative instruments (Mees et al, 2014; Burkas and Sallnäs 2012). Henstra (2016) adds one more category, organization, to the framework and offers a detailed explanation and categorization of all the policy instruments:

- Information based instruments are focused on the lack of sufficient knowledge about how to proceed. Information based instruments can be used to motivate targets and goals, which must be sufficiently motivated to take action before actors will contribute to the policy goals (Henstra, 2016). Communication instruments entail on the facilitating of inclusive, active, and iterative communication between knowledge users and producers, to ensure mutual awareness of needs and to include stakeholders in relevant dialogue. Governments translate the language, jargon, experiences and presumptions of experts and decision makers to ensure mutual understanding and agreement about what information is reliable (Henstra, 2016).
- Organizational instruments. Governments can invest in making their own property climate adaptive and educate their own staff about what they can do for climate adaptation. This can lead to a more integral approach within the governments and can set a good example for the other actors to climate adapt their property. In addition, this will give the governments knowledge about the practicalities that could occur when climate adapting public property, their buildings or convincing their staff about climate adaptation goals (Henstra, 2016).
- Economic instruments can be used in many ways to support climate adaptation. Economic instruments generally involve the use of public funds to produce and maintain public goods and services, to induce targets to adopt policy-preferred behavior, or to impose costs on targets in order to discourage undesirable behavior. The last two arguments assume that

actors will not voluntarily take action unless they are motivated by financial incentives or disincentives (Henstra, 2016).

- Legal instruments refer to the legitimate power of the state to prohibit, permit or command action by targeted populations. Actors are assumed to be motivated by a commitment to obey government-issued directives, either because they are legally required to do so and fear penalties for non-compliance, or because they respect the legitimacy of the government. In case of the province or the national government, when other governments are the policy targets, compliance is expected as part of the hierarchical order established in constitutional or statutory rules. Legal instruments can be deployed in many forms and uses, making it an essential tool for adaptation policy (Henstra, 2016).

The four dimensions are further operationalized in table 1. There is an overall consensus that there is no one-size-fits-all approach, and a tailor-made mix of policy instruments, accustomed to the specific context of a particular climate adaptation issue, is necessary in each individual case (Termeer et al., 2017). These instrument mixes are complex, given the nature of tools involved and how they relate to each other. Instruments can be used in the policymaking process trying to affect activities such as agenda-setting or the formulation of goals, as well as more classical implementation tools such as the use of financial subsidies and other means to affect policy change in practice (Capano & Howlett, 2020).

These tools are commonly implemented in a mix or bundle which creates interactive effects within the policy instrument mix. They can be complementary or supplementary but can also feature counterproductive effects amongst each other. On the contrary, they can also produce synergies when two or more tools, put into practice together, are more effective than when deployed alone. When supporting a policy strategy, tools in an instrument mix can be considered to be consistent or complementary when they all work towards the same goal (Capano & Howlett, 2020). However, instrument mixes which do not contain complementary instruments can lead to an inefficient policy instrument mix. Not all tools are designed entirely complementary and some instruments within the same mix generate counterproductive responses in policy goals. A key principle of current policy design thinking is to maximize complementary effects and minimize conflicting ones (Capano & Howlett, 2020). Which policy instruments are currently applied for climate adaptation and which instruments are missing or malfunctioning will therefore be researched within this thesis to maximize these complementary effects.

2.6.3 Operationalization

Further operationalization of the four categories has been provided by Henstra (2016):

Information and communication instruments	<ul style="list-style-type: none"> - Knowledge generation: scientific study to support adaptation decisions - Indigenous knowledge: knowledge gained through lived experience - Projections: probabilistic simulations of climate change within different scenarios - Scenarios: plausible descriptions of future climatic situations and social and economic changes, which guide evaluation of policy options - Visualization: graphic depictions of future climate scenarios - Education and training: knowledge acquisition about climate change and adaptation
--	---

	<ul style="list-style-type: none"> - Exhortation: reasoned, normative arguments intended to convince targets to engage in climate adaptive behavior - Facilitate communication between stakeholders - Knowledge-sharing networks: collective systems for sharing ideas, knowledge and experiences between actors. - Boundary organizations: institutions that facilitate communication between knowledge producers and users, translating between experts and decision makers, and mediate conflicting views
Legal instruments	<ul style="list-style-type: none"> - Legislation: statute law to allocate responsibilities, grant decision-making authority, define liabilities, and enable other instruments - Intergovernmental mandate: legal directive commanding climate adaptation by lower-level governments - Regulation: state-prescribed rules to enforce climate adaptation - Zoning: rules about allowed spatial activities for parcels of land - Standards: rules about the design, construction, and maintenance of buildings and infrastructure systems - Building code: national set of rules requiring minimum standards for construction
Economic instruments	<ul style="list-style-type: none"> - Direct program spending: strategic public investments to achieve adaptive goals on the following: <ul style="list-style-type: none"> - Public goods and services - Flood protection, emergency planning, warning systems - Infrastructure: increasing resilience of infrastructure systems to ensure service continuity - Ecosystem management: public investments to protect, restore, and manage ecological systems - Relocation: purchase of exposed properties or assets in vulnerable areas - Financial incentives: public funds to encourage adaptation behavior - Grant: conditional financial transfer granted on a competitive basis and accompanied by reporting requirements - Subsidy: conditional contribution to encourage a climate adaptive activity - Taxation: state levy to raise income and influence behavior - Corrective (disincentive) tax: levy to offset costs of undesirable behavior or incentivize behavioral change

	<ul style="list-style-type: none"> - Tax deductions and credits: reduction in tax to incentivize adaptation behavior
Organizational instruments	<ul style="list-style-type: none"> - Demonstration: 'climate-proofing' government-controlled facilities, assets, and operations - Procurement: Integrating adaptation objectives into purchase of goods, works, and services

Table 1: Operationalization of policy instruments, Henstra (2016)

2.7 Conceptual model

The disclosed theories have been conceptualized within the following conceptual model. The policy arrangement provides the temporary stabilization of the content and organization of a policy domain. This temporary stabilization includes the actors, resources, rules of the game and the discourse. The current policy arrangement in the province of Limburg influences the policy instruments being used by the province, the water authority, and the municipalities. How the policy arrangement aligns to the policy instruments is depicted by the arrow. The policy instruments can be divided in the information and communication instruments, economic instruments, legal instruments and organizational instruments. These four categories will be further operationalized in appendix C.

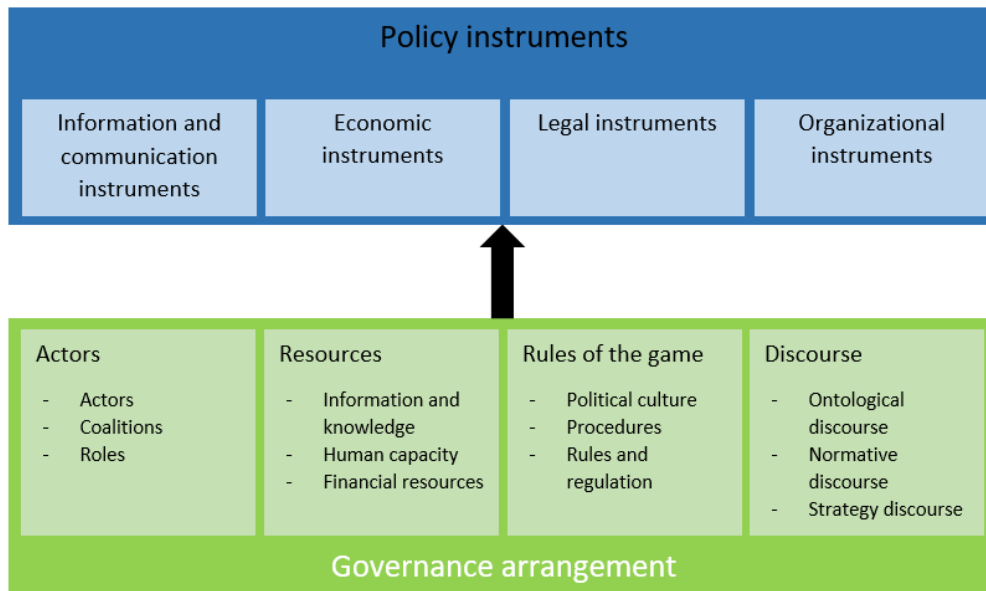


Figure 3: Conceptual framework (own work)

2.8 Operationalization

The policy arrangement and the policy instrument theory are operationalized in the following table. The indicators of the policy arrangement will be used in the case study. The indicators of the policy instruments will be further operationalized to adjust the indicators to the Limburgish instruments. When applying this initial operationalization and practicing the survey with municipal and provincial civil servants it was found to be too abstract and unpractical to question in a survey. Therefore the case specific instrument mix is operationalized beforehand. Instruments who appeared during the interviews were added inductively at a later stage. The local policy instrument operationalization can be found in appendix C.

Theory	Category	Indicator
Policy arrangement	Actors	<ul style="list-style-type: none"> - Actors - Coalitions - Roles
	Resources	<ul style="list-style-type: none"> - Information and knowledge - Human capacity - Financial resources
	Rules of the game	<ul style="list-style-type: none"> - Political culture - Procedures - Rules and regulation
	Discourse	<ul style="list-style-type: none"> - Ontological discourse - Normative discourse - Strategy discourse
Policy instruments	Information and communication	<ul style="list-style-type: none"> - Knowledge generation - Indigenous knowledge - Projections - Scenarios - Visualization - Education and training - Exhortation - Facilitate communication between stakeholders - Knowledge-sharing networks - Boundary organizations
	Economical	<ul style="list-style-type: none"> - Direct program spending - Relocation - Financial incentives: public funds - Grant - Subsidy - Taxation - Corrective (deterrent) tax - Tax deductions and credits
	Organizational	<ul style="list-style-type: none"> - Demonstration - Procurement
	Legal	<ul style="list-style-type: none"> - Legislation - Intergovernmental mandate - Regulation - Zoning - Standards - Building code

Table 2: Operationalization theories

3. Province of Limburg

The province of Limburg consists of 31 municipalities and has historically and politically been divided into three regions: North, Middle and South (Provincie Limburg, 2020).

Municipalities work together within these regions on multiple subjects. The water work regions have been arranged in a slightly different division. It is important to mention this division as the province contains various types of vegetation and types of soil which requires different climate adaptation measures. As shown on the map the regions North and Middle Limburg contain different types of landscape than the South of Limburg. The north consists of sand grounds which quickly drains the water and has less height differences than the south of Limburg. The south of Limburg consists of loess soils, which hardly absorb water, and contains more height differences. Therefore the north is more prone to drought and the south is more prone to water nuisance (Provincie Limburg, 2020).

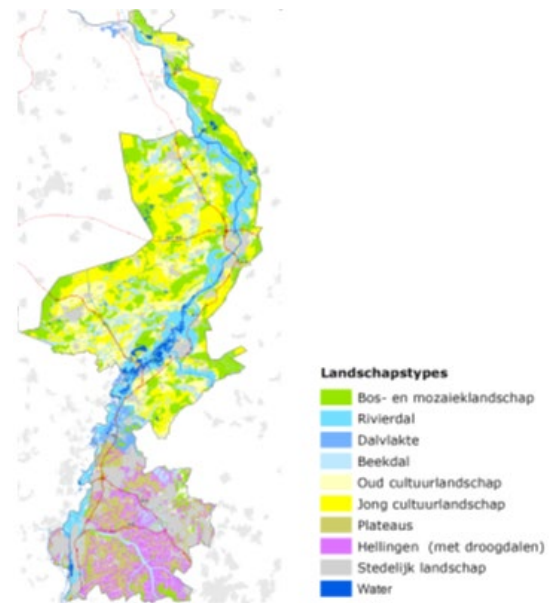


Figure 4: Landscape types, Province of Limburg 2021

3.1 Regions

The province of Limburg is divided in four water regions. From the national level, the Delta Program Spatial Adaptation got distributed across the water regions. These existing partnerships are the foundation where municipalities work together on all water related subjects, which since a few years includes climate adaptation. The regional implementation programs get written per water region. Parkstad has chosen to write their implementation program outside of the water region and created a multidisciplinary team with civil servants with different backgrounds. There are four water regions: Waterpanel Noord, Westelijke Mijnstreek, Maas en Mergelland and Parkstad which differ in size as well. Waterpanel Noord consists of 15 municipalities, Westelijke Mijnstreek consists of 3 municipalities, Maas en Mergelland consists of 6 municipalities, and Parkstad consists of 7 municipalities. All of the water regions are working together with the water authority, water company Limburg (WML) and the province. At the moment Waterpanel Noord and Maas- en Mergelland are the only regions that have finished their regional implementation programs and will start implementing their agreed upon goals this year. The other two regions aim to finish their regional implementation programs by 2022.

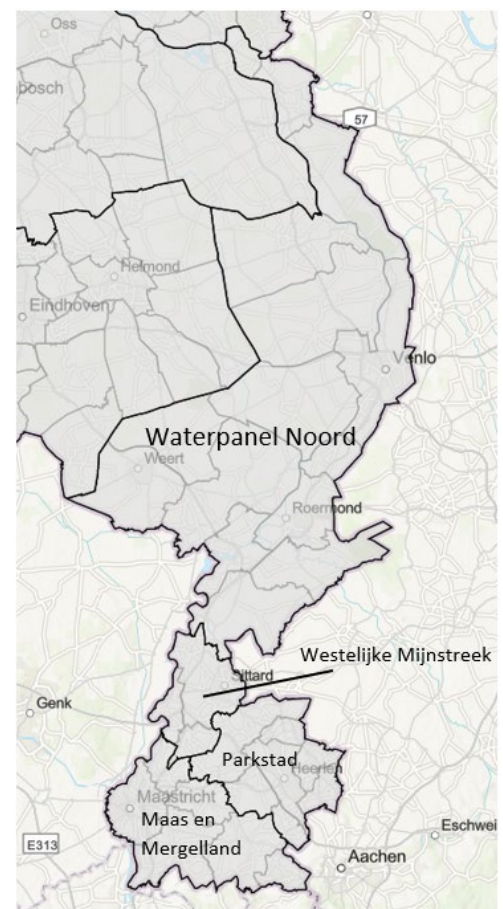


Figure 5: Climate adaptation regions (CBS, 2021)

4. Methodology

This chapter elaborates on the methodology of the research. This includes the research philosophy, the research strategy, the methods, data collection and the analysis of the data. Finally, the validity and reliability of the research will be discussed.

4.1 Research philosophy

The research philosophy provides the fundamental backbone of a master thesis. There are two essential parts within a research philosophy: ontology and epistemology. Ontology refers to the assumptions we have about reality and shapes. In addition, ontology refers to the perspective of the researcher about the nature of reality and the research objects. Epistemology refers to the assumptions we have about knowledge and to the beliefs a researcher has on how to develop knowledge and communicate it (Guba & Lincoln, 1994).

Researchers can have an objectivistic or a subjectivistic view on the ontology and epistemology. Objectivists have the general assumption that reality is external and cannot be changed by social actors. Subjectivists have the general assumption that reality is constructed through the perceptions and actions of social actors. Knowledge is then created as a result by a combination of different beliefs and views that are specific for each analyzed situation (Saunders et al., 2019). Policy instruments are political choices which are made by locally constructed perceptions of social actors to achieve change within subjects they perceive as a problem (Termeer, 2017). The choice is based on the views and beliefs of local authorities, perhaps in cooperation with views and beliefs of other important stakeholders, and are therefore subjectivistic. This research will overall thus take a more subjectivist stance.

Positivism

The research philosophy within this thesis will be partly related to positivism. In order to create a general overview of the current policy instruments mix, and therefore a temporary reality, the positivism research philosophy is more suiting. Positivism relates to the philosophical stance of the natural scientist and entails on working with an observable social reality to produce law-like generalizations. Epistemologically the research would focus on discovering observable and measurable facts and regularities, where phenomena can be observed and measured (Saunders, 2019). Within this thesis one temporary policy instrument mix can be observed which consists of the several individual instruments. The existing instrument mix can therefore be perceived as facts uninfluenced by human interpretation or bias.

Interpretivism

The research philosophy mainly applied within this research is interpretivism. Interpretivism is a research philosophy which emphasizes that humans are different from physical phenomena because they create meanings. Different people of different backgrounds, under different circumstances and at different times, make different meanings and therefore create and experience different social realities. The main purpose of research is to create new, richer understandings and interpretations of social worlds and contexts (Saunders et al., 2019). The policy arrangement and the experiences with the different policy instruments are perceived realities and interpretations of the interviewed actors. In this research interpretivism refers to analyzing the policy arrangement and the policy instruments from the different perspectives of the respondents of the province, the water authority and the municipalities, and gaining a deeper understanding of the emergence of the current policy instrument mix.

Theoretical approach

The theoretical approach of this research is both deductive and inductive. Firstly, the theories of the policy arrangement and policy instruments have been applied to the case of Limburg to discover the current policy arrangement and its policy instruments. The theoretical framework and the dimensions of the policy arrangement and the policy instruments have been applied to the cases and are therefore deductive. Secondly, the alignment between the policy arrangement and the policy instruments will be analyzed in an inductive manner, as these factors have to appear from the retrieved data. Finally, additional categories to the existing framework within the theories were added inductively.

4.2 Research strategy

This thesis will use a mixed methods approach and therefore makes use of both qualitative as quantitative methods. The main focus of this research will be within qualitative methods as this research studies complex relations between the policy arrangement, the use of policy instruments and the barriers within these mixes. It therefore goes into depth which better suits a qualitative research method (van Thiel, 2014). Next to the qualitative methods quantitative methods have been used to answer part of the first sub-research question about the current instrument usage, which required a general overview and operationalization of the current instruments. The quantitative data operationalized the policy instruments used within the province of Limburg and supports the findings within the qualitative data. The research strategies that have been used in this thesis are therefore the case study for the qualitative data, and the survey for the quantitative data.

4.2.1 Case study

A case study is an in-depth study into a topic or phenomenon within its real life setting (Saunders et al., 2019). A case can contain several cases of the subject of study and takes a holistic approach where mainly qualitative data is gathered on aspects of the case. A case can be anything, from an organization, to a city, to a neighborhood (van Thiel, 2014). The case in this research will be the province of Limburg, its municipalities and the water authority Limburg. This case has been chosen because the province of Limburg has been severely affected by climate change and is therefore an interesting case to examine if the current policy instruments usage of the Limburgish governments within climate adaptation is efficient. In addition, an internship was conducted within the province of Limburg, which made the usage of multiple data sources and using connections for interviews more easily accessible. The three governmental levels (province, municipality and water authority) have been selected because they have the authority to implement most policy instruments and will therefore act as the research units within the case.

Selection criteria of the municipalities

Six municipalities were selected to participate in the research. This was based on two criteria; *location* and *size* of the municipality. The north of Limburg faces different obstacles and challenges regarding climate adaptation than the south of Limburg. This is dependent on the type of soil and the height differences within the municipality. The middle of Limburg has the same type of soil as the north of Limburg, but is surrounded by water, leaving little room for expansion in some municipalities (Waterschap Limburg, 2021). Therefore the selected municipalities were divided within the north, middle and south of Limburg.

The second criteria is the size of the municipality. This criteria has been selected because literature assumes that bigger municipalities have more economical resources, which means they are more capable to implement economical instruments than the smaller municipalities (Lesnikowski, Biesbroek,

Ford, & Berrang-Ford, 2021). Therefore one big and one small municipality were selected within each location. An added criteria is to take the four climate regions into account and select municipalities from different regions in the south of Limburg, as the regions have their own strategy and therefore a different perspective on climate adaptation (Personal communication, 2021). Eventually this led to the following case selection:

Municipality	Location	Size	Region
Venlo	North Limburg	Big	Waterpanel Noord
Beesel	North Limburg	Small	Waterpanel Noord
Roermond	Middle Limburg	Big	Waterpanel Noord
Roerdalen	Middle Limburg	Small	Waterpanel Noord
Maastricht	South Limburg	Big	Maas en Mergelland
Simpelveld	South Limburg	Small	Parkstad

Table 3: Case selection

Within the municipalities the choice was made to mainly interview the water civil servants, as climate adaptation is predominantly organized within the water domain and is part of the water civil servants range of tasks (Personal communication, 2021).

Selection provincial and water authorities civil servants

The selection of the interviews with the province and water authority was based on including the civil servants working on climate adaptation, which were mostly civil servants working in the water domain. These civil servants often have parts of climate adaptation included within their functions. An example is the civil servant of the regional water system, a civil servant for drought and a civil servant for the main water system within the province (Personal communication, 2021). This resulted in five interviews with provincial actors and two interviews with the water authority.

Selection water regions

As argued before there are four work regions within Limburg who mainly implement climate adaptation. These regions perform the stress tests, risk dialogues and implementation program. At the moment, most of the progress being made in climate adaptation is done at a regional level (Observation 1). Therefore the four process and program coordinators of the regions were added to the research.

Additional interviews

Additional interviews within all three governmental levels were held via snowballing. During the course of the research several governmental actors appeared which have played a role in important policy instruments, such as the one million tree plan coordinator and the project leader of Waterklaar, which were recommended by the respondents to add to the research. These were later interviewed as well.

4.2.2 Survey

The second research strategy is the survey. This research strategy allows the researcher to collect a considerable body of data on a large number of subjects, which makes it highly efficient for research (van Thiel, 2014). This research covers the entire province of Limburg, therefore getting information of the various municipalities is best conducted via a survey. The options of policy instruments are, in theory, the same in each municipality. These instruments will be operationalized beforehand to suit the case of Limburg. This will be done in cooperation with the provincial civil servants and checked by a municipal civil servant. Therefore the instrument list will become saturated and the survey

becomes a suitable manner of conducting data. The participants were questioned about which policy instruments are currently implemented for climate adaptation within their municipality. Therefore the survey produces an overview of the used policy instruments, which is necessary for the qualitative part of the research which focusses on the improvements of the used policy mix.

The units of study in a survey are the respondents, which are the civil servants within the municipalities working on climate adaptation. These have been selected by inviting all the municipal participants of the AKAL (provincial climate adaptation meeting) and the regional climate adaptation meeting of Parkstad. Because Parkstad has created a separate team for climate adaptation these civil servants were invited additionally to the AKAL participants. The AKAL is the provincial climate adaptive meeting where it is assumed all municipal civil servants working on climate adaptation have joined this meeting. In the accompanying email the question was raised to send the survey to other civil servants which might have been overlooked and are working on climate adaptation as well. The province of Limburg and the water authority were questioned about their instrument usage within interviews.

4.3 Research method and data collection

The research methods used in this research are policy documents, semi-structured interviews, a survey and observations. Policy documents have been used as background information about climate adaptation within the province of Limburg. These documents were mostly regional or local implementation programs, the provincial water plan and the environmental vision, and the water authorities' water program. An overview of the documents can be found in appendix A.

4.3.1 Interviews

Interviews are a flexible way of collecting data and are an often applied research method in case studies (Yin, 2009). In depth interviews are used to discover a shared understanding of a particular group. To gain knowledge about the existing policy arrangement and the policy instruments, semi-structured interviews were conducted within the province of Limburg, its municipalities and the water authority. The advantage of interviews is to gain more in-depth knowledge, getting the opportunity to ask follow up questions and to clarify unclear answers during the interview (van Thiel, 2014). In total, 26 in-depth interviews were conducted. A semi-structured approach was taken for conducting the interviews, which means an interview guide was used as a guideline. The interview guideline used the categories which are central in the theoretical framework. The interview questions are based on the operationalization of the categories derived from the theoretical framework.

A first round of interviews with the municipalities was conducted with the aldermen of six municipalities, as they take the political decisions and therefore decide which policy instruments will be used. They also have a more generic overview about climate adaptation, which is a wide spread topic and not solely water related. Only one alderman, of the municipality of Maastricht, did not have time to conduct an interview and therefore send the civil servant water, climate adaptation and housing in his place. This round of interviews focused on the policy arrangement, the policy instruments that should be implemented in their municipality, and what the province could do to improve climate adaptation.

This research was conducted during an internship period within the province of Limburg and therefore this research was partly combined with the internship assignment assigned by the province. This separate report focused on how the province could improve their role within climate adaptation in the urban area, and therefore part of the first round of interviews included several questions about the future role of the province. These question could be well adjusted to the policy

arrangement, which also includes the role of the actors, and will be incorporated partly in this thesis. A remark to this report is the focus on the urban area. Overall the province divides climate adaptation in the following manner: the urban area, where the municipalities have to implement climate adaptation, and the rural area where the province and the water authority implement climate adaptation (Personal communication, 2021). The main question of the report subsequently focused on the input of the municipalities for a future provincial role. Therefore the scope of this report does not interfere with the general scope of this research, as the questions within the policy arrangement were not specifically aimed at the urban area but were later filtered from the data for the province.

A second round of follow up interviews were conducted with multiple municipalities' civil servants about which policy instruments are being used, which instruments they are still missing and which ones are malfunctioning. Any missing information or follow up questions that went into more detail than the alderman could provide were questioned as well. These were conducted within the same six municipalities and thus served as follow up interviews, as the aldermen were not always aware of all the policy instruments being used within their municipality. From the six original participating municipalities, four were willing to conduct an interview for the second time. One municipality did not have time to cooperate again while the other was not as far along in the process of climate adaptation, making one interview sufficient to cover the subject within the municipality. These follow up interviews were mostly conducted with the water civil servant and sometimes included the green, energy or infrastructure civil servants. An overview of the two rounds is presented below.

First round of interviews municipalities	Function	Concerning
Venlo	Alderman	Policy arrangement, policy instruments and role of the province
Beesel	Alderman	Policy arrangement, policy instruments and role of the province
Roermond	Alderman and water civil servant	Policy arrangement, policy instruments and role of the province
Roerdalen	Alderman and water civil servant	Policy arrangement, policy instruments and role of the province
Maastricht	Civil servant housing and climate adaptation	Policy arrangement, policy instruments and role of the province
Simpelveld	Alderman and water civil servant	Policy arrangement, policy instruments and role of the province
Second round of interviews municipalities	Function	Concerning
Venlo	Civil servant water & civil servant green	Policy instruments & missing information
Beesel	Civil servant climate adaptation, green & water	Policy instruments & missing information
Roerdalen	Civil servant water	Policy instruments & missing information

Simpelveld	Civil servant water, energy transition & infrastructure	Policy instruments & missing information
------------	---	--

Table 4: Interviews municipalities

Interviews regional climate adaptation coordinators

The four process and program coordinators of the work regions were interviewed about both the policy arrangement and the policy instruments, with an additional focus on the stress tests, risk dialogues and implementation programs. These are currently mostly conducted at a regional level. Therefore these three policy instruments formed a category within these interviews to be able to analyze these instruments on a regional level. It was especially important to interview these respondents in two of the four regions (Westelijke Mijnstreek and Parkstad), as their regional agendas are still being written and therefore no documents could be used. All four coordinators were willing to participate in the research.

Interviews regional coordinators	Function	Concerning
Waterpanel Noord	Coordinator & civil servant municipality of Weert	Policy instruments (focus on stress tests, risk dialogues and implementation agenda)
Parkstad	Coordinator & civil servant municipality of Beekdaelen	Policy instruments (focus on stress tests, risk dialogues and implementation agenda)
Westelijke Mijnstreek	Coordinator & civil servant municipality of Sittard-Geleen	Policy instruments (focus on stress tests, risk dialogues and implementation agenda)
Maas- en Mergelland	Coordinator and employed at consultancy firm	Policy instruments (focus on stress tests, risk dialogues and implementation agenda)

Table 5: Interviews regional coordinators

Interviews water authority

The water authority Limburg has been interviewed simultaneously. The first interview was held with the program coordinator climate adaptation which contained the policy arrangement and partially the applied policy instruments. A second interview was held with another civil servant concerning one of the policy instruments; the disconnection of the sewage arrangement of the water authority. These interviews were sufficient to create an overview of the water authorities policy arrangement and policy instruments.

Interviews Water authority	Concerning
Strategic civil servant / program coordinator climate adaptation	Policy arrangement and policy instruments
Civil servant urban water	Disconnection of the sewage subsidy

Table 6: Interviews water authority

Interviews province of Limburg

Because of the internship within the province of Limburg there were plenty of opportunities to interview provincial civil servants. Firstly, the deputy concerning housing, space, water and agriculture was interviewed regarding the discourse of the province, the role of the province, and the future use of policy instruments. Secondly, two civil servants, one concerning the regional water

system and one with the main water system, were interviewed regarding the policy arrangement and the choice of policy instruments. Thirdly, two civil servants were interviewed about subsidies regarding climate adaptation subjects (DHZ and POP-3) issued by the province. In addition, the cluster manager got interviewed about the organization of climate adaptation. Questions about legal instruments were answered by the legal counsellor of the cluster by personal communication. Finally, during the interviews with the municipalities one provincial subsidy, in the perspective of the municipalities, needed improvement and therefore the coordinator of the plan within the province got interviewed as well (one million tree plan).

Interviews Province of Limburg	Concerning
Civil servant main water system and regional water system	Policy arrangement and policy instruments
Civil servants drought and POP-3	Policy instruments (POP-3 and DHZ)
Provincial depute housing, space, water and agriculture	Future policy instrument usage and discourse
Cluster manager nature and water	Organization of climate adaptation
Civil servant one million tree plan	One million tree plan

Table 7: Interviews province of Limburg

Interviews other provinces

The report written for the province required research about how other provinces have organized climate adaptation, which role they take and which policy instruments they use. Therefore the two provinces of Gelderland and Noord-Brabant got interviewed. For this master thesis these two interviews will be used as a comparison to the role of the province of Limburg. An overview of all interviews is included in appendix A.

4.3.2 Observations

Finally, several observations were performed during the internship within the province of Limburg about climate adaptive subjects. Climate adaptation is mainly discussed within provincial and regional meetings (AKAL/BKAL and regional meetings). Within these meetings the actors discuss climate adaptive topics and which constraints they experience within the process of becoming climate adaptive. This is valuable background information to get an understanding about how the climate adaptation policy process is functioning in practice and at what point in the policy process actors are currently situated. To document these meetings reports have been made and analyzed.

Reference	Observations	Subject
Observation 1	Ambtelijke Klimaat Adaptatietafel Limburg	Proceedings within the different work regions, the new water coalition, a presentation of the ministry about climate adaptation
Observation 2	Bestuurlijke Klimaat Adaptatietafel Limburg	Main subject: the flooding of last summer, what have we learned, personal experiences of aldermen of Kerkrade, Valkenburg and Roermond.

Observation 3	Brainstorm session Parkstad Limburg	Brainstorm session with the Parkstad region about how to continue the greening projects within the region
Observation 4	Meeting water region Limburgse Peelen Venlo – Venray	Meeting about all water related subjects within the region, including climate adaptation, and the regional budget
Observation 5	Meeting climate adaptation region Parkstad	Meeting about their implementation program. Discussing the strategy within this program
Observation 6	Meeting water region Westelijke Mijnstreek	Discussing the new rainwater disconnecting table, including introduction by province and water authority. Updates about several subjects including climate adaptation

Table 8: Observations

4.3.3 Survey

In order to get an overview of all current climate adaptation policy instruments within Limburgish municipalities, all participants of the Official Climate Adaptation Table (AKAL), or officials otherwise involved in climate adaptation via the regional adaptation meetings, were invited to fill out the survey. The questions of the survey can be found in appendix D and are structured within the four previously defined policy instrument categories. To ensure an all-encompassing and well-functioning survey the questions were submitted to contact persons within the province beforehand, in order to remove inaccuracies and/or ambiguities.

The survey was set up to reduce the non-response as much as possible. Non-response is the percentage of respondents from the sample who cannot or will not participate in the survey. A high non-response rate can have major consequences for interpreting the outcomes of a survey (Korzilius, 2008). Therefore, firstly, measures were taken regarding the content of the survey. In order to prevent a high non-response rate, the choice was made for an attractive, not too long questionnaire. For each type of instrument, a short introduction and/or description was given for each type of policy instrument (Korzilius, 2008). In addition, a cover letter was drafted, explaining the research purpose and the research itself. Finally, measures were taken to encourage the completion of the survey by indicating beforehand how long it would take to complete the survey.

Limburg consists of 31 municipalities. The survey was completed 27 times by 21 different municipalities. This gives a fairly complete picture of the policy instruments usage of the municipalities within the province of Limburg. The enclosed map shows which municipalities participated in the survey. The data and percentages retrieved from the survey will be used as supporting information for the data retrieved from the interviews.

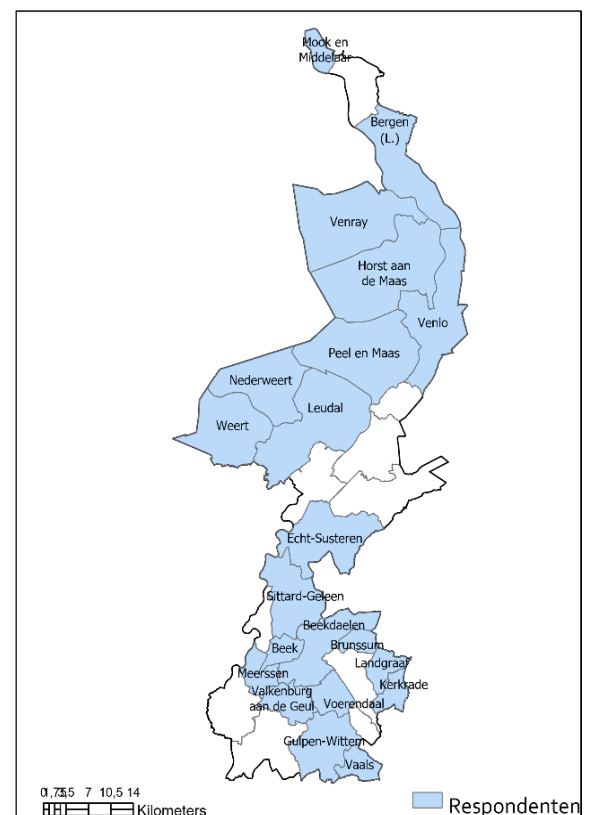


Figure 6: Map of participating municipalities (own work)

4.4 Data analysis

Firstly, most of the research methods that will be used are of a qualitative nature. Which means that the data contains large amounts of (transcribed) texts retrieved from the interviews and the observations. All interviews have been recorded and transcribed. The observation reports have been added as well. This large body of data has been analyzed in a systematic approach by using Atlas.ti (van Thiel, 2014).

When all the data has been retrieved the researcher starts structuring the data. This has been done by coding the text. A code is a way of indicating what a certain qualitative data unit actually means. It is a brief summary of the main attributes or features of the unit. The data will be coded by following the guideline of the operationalizations of the theories developed in the conceptual model. These will help to decide what is relevant within this research and what is not (van Thiel, 2014). For complementing the already existing theories inductive coding will be used, which refers to paying attention to similarities and differences and trying to find patterns. When the data has been coded and integrated, the different codes and categories will be compared and contrasted with each other to search for patterns, cause and effect relations, and other forms of interconnection (van Thiel, 2014). The code scheme has been added to appendix G.

Data analysis survey

In this study, descriptive statistics have been used to analyze the quantitative data. This refers to the description of data from a research group. The processing of the results is done by using SPSS. The results of the survey are presented by means of frequency distributions in (cross) tables. The main aim of this survey is to generate an overview of the policy instruments and the usage of these instruments within the municipalities. Because of the relatively low amount of participants and because of no causal relations being questioned in the survey the percentage of instrument usage has been sufficient to reach this goal.

4.5 Validity and reliability

Validity can be divided in internal and external validity. The extent to which the theory matches with the research results indicates the degree of internal validity. It refers to the researcher measuring what the research intended to measure, and if the effect that can be observed in the dependent variable is attributed to a change in the independent variable (Van Thiel, 2014). To improve the internal validity triangulation has been used to measure all the variables within the research. Using multiple methods increases the chance to measure the variables correctly (Verschuren & Doorewaard, 2010). Therefore documents, interviews, a survey and observations were used to retrieve data for this research.

To increase the internal validity the focus during the interviews and observations has been put on that what was truly observable, and were performed with an, as much as possible, objective attitude with caution for misunderstanding and misinterpretation (Vennix, 2012). The internal validity within the survey has been increased by testing the survey beforehand by provincial civil servants and a municipal civil servant to check for errors and mistakes and if the operationalization included all the policy instruments. Secondly, an invitation letter was attached where an explanation was given of the research and instructions about the questionnaire to prevent mistakes or misunderstandings among respondents (Vennix, 2012).

External validity refers to the extent you can generalize your research results. Within qualitative research this can be slightly problematic because of the usage of case studies which makes it difficult to generalize data. This is caused by the small number of cases and the fact that institutional contexts

can vary greatly. This means that the research situation is unique and therefore the research results will be less relevant for other cases (Bryman & Bell, 2011). The external validity within this research has been increased by the usage of the survey which measures the usage of policy instruments within municipalities. Therefore the usage of the policy instruments within Limburg can be generalized.

Reliability

Reliability of a research means that the research is replicable. The content of the research in order to be reliable should not be dependent upon one researcher or method. If the research can be repeated in the same way, it should lead to the same results (Verschuren & Doorewaard, 2007). A reliability issue with qualitative case studies is that data collection and analysis requires a lot of personal interpretation from the researcher, which, if not structured adequately, might lead to different outcomes if the research is repeated. To achieve reliability the interview guides (included in appendix F) have been derived from theory. The interviews have also been recorded and transcribed to improve reliability. Secondly, to improve reliability codes have been used to structure the interviews and a codebook has been included to derive the structure of the codes, which can be traced back to the quotes made within the interviews. This should lead to a reliable and valid research.

5. Results

The results of this research will be analyzed in this chapter. The current policy arrangement will be analyzed using the policy arrangement theory. At the end of each category the factors influencing the policy instruments will be described and analyzed. This will result in a table with all the factors aligning to the policy instruments in paragraph 5.2. This will provide the context where the policy instruments are implemented in. Next, the current policy instrument usage will be described and analyzed. Each individual category will analyze the current policy instrument usage, if these policy instruments are malfunctioning and which policy instruments are missing. For the overall overview paragraph 5.4 contains the current complete policy instrument mix, including the recommendations.

5.1 Policy arrangement

The policy arrangement depicts the current policy domain of climate adaptation within the three governmental levels. Climate adaptation is a relatively new concept which is not completely institutionalized yet. Therefore climate adaptation is a subject that often gets linked with other goals and projects, resulting in a fragmented policy area within the governments. This chapter will analyze the current policy arrangement within climate adaptation by its existing discourses, important actors, the resources and the rules of the game within the policy arrangement. In paragraph 5.2 the alignment of the policy arrangement with the policy instruments will be analyzed to recognize the patterns and factors influencing the instrument usage.

5.1.1 Discourse

Discourses refer to the narrative of climate adaptation and include problem definitions, the articulation of a cause, a possible solution (a policy program or strategy) and a concrete goal (ideal situation) (Lieverink, 2006). This paragraph will analyze the current discourse of climate adaptation within the province of Limburg.

Definition of climate adaptation

All interviewed governmental levels acknowledge climate adaptation is necessary to adapt the living environment to climate change and more extreme weather events to reduce future damage. Climate adaptation therefore refers to adapting the environment to a changing climate. Climate change gets defined by the three governmental levels as; the climate is getting warmer, dryer, and there will be more precipitation and floods (interviews 9,16,17). This can have various negative effects such as, longer and more intense drought periods, extreme weather events, and large amounts of precipitation in a short period of time causing flooding and water nuisance (interviews 6,13,15,17,19).

Operationalizing climate adaptation

Climate adaptation proved to be a hard term to operationalize for governments as it relates to multiple policy domains. The Delta Plan defined climate adaptation as a water related issue which contains four main themes; drought, heat stress, flooding and water nuisance. This definition is maintained on a national (Delta Plan) and provincial level (interview 26). Contrary to this definition, at a municipal level climate adaptation is defined as a broader subject that touches many other policy domains such as housing, infrastructure and green. The municipalities would preferably implement climate adaptation in this broader definition, but face the obstacles created by the more narrow definition of the higher level governments. Heat stress and green measures, for example, are seen as linking opportunities by the Delta Plans which makes it more difficult to include heat stress and green related measures for lower level governments (interviews 4,7,8,21,24). This water dominated discourse causes multiple obstacles later within the policy instrument usage as climate

adaptation gets organized within the water department, has a water dominated funding system (Delta plans) and created generally more information instruments within water related subjects.

Climate adaptation contains uncertainty

Another characteristic of climate adaptation is the level of uncertainty. It is unknown how certain areas are going to be affected by climate change and to what extent preventive measures are sufficient. For example, it is uncertain how many millimeters of water retention is sufficient and if a flood standard will still be manageable in the future (interviews 1,5,9,13,17,20). These questions have resulted in discussions about if the governments should try to avoid the effects of climate change at all costs or to what extent the damage is acceptable (interviews 13,24). In relation to the policy instruments no link could be found if this uncertainty leads to less sufficient policy instrument usage. Municipalities currently rely on the knowledge provided by institutes such as the KNMI, the stress tests or the LIWA (research visualization of future scenarios) of the province of Limburg to base their policy decisions upon (interview 16).

“I'm not going to mitigate damage at any cost. It has to be in proportion to the measures we take and the nuisance we are going to reduce. So the bottlenecks from the stress test we have solved except for one where it was not efficient; meaning the costs were outweighing the benefits in our perspective.” – Municipality of Beesel (24:16)

An ideal climate adaptive environment

Based on regional implementation agendas, municipal visions, the water authorities' and provincial plans, the 'ideal climate adaptive situation', and therefore the goal, gets described as the following¹:

A climate adaptive environment with no more water nuisance in the urban area, the chance of flooding has been drastically reduced, the urban areas will contain much more green and more trees, every home has a sedum roof or green façade and is disconnected from the sewage, climate adaptation and biodiversity is intertwined within every spatial project, streams and brooks have regained their natural meandering character, there is more space for water and biodiversity, the irrigation of agricultural parcels has been reduced or no longer occurs, crops are provided with moisture drip irrigation or exceptionally by groundwater, a solution has been found to drain large amounts of water quickly and buffer it in the rural area to reduce drought and water nuisance, and the agricultural sector has adapted to a more Mediterranean way of farming.

A climate adaptive strategy

To reach this ideal climate adaptive situation several strategies are implemented. Overall there are two strategies that can be recognized; the implementation programs of the four regions, and climate adapting the rural area by the province and water authority.

Climate adaptive strategy rural area

Climate adapting the rural area mostly refers to solving big bottlenecks and climate adaptive programs in the rural area. These bottlenecks are often a source of a climate related problem and, especially for water nuisance, have a big effect on their surrounding areas. Therefore these

¹ Based on following documents:

- Provinciaal waterprogramma (2021)
- Waterbeheerprogramma Waterschap Limburg (2021)
- Uitvoeringsagenda Venlo, Horst aan de Maas & Roerdalen (2022)

bottlenecks are often prioritized (interviews 17,19). Next to the bottlenecks the province and the water authority have a multitude of projects concerning climate adaptation which are often connected to water related subjects. Within these strategies three main focal points are apparent, which is reducing drought (Room for the brook and area-based approach Peelen); preventing water nuisance (Water in Balans and the area-based approach Geul); and preventing floods by taking measures to comply with the flood standard (interviews 17,26).

Regional climate adaptive strategies

On a regional level there are four climate adaptive strategies which are the regional implementation programs (interviews 15,16,19,20). Each region has their own definition of climate adaptation, their own measures to become climate adaptive, and their own area specific features they have to take into account. Intrinsicly, all regions describe climate adaptation as the climate is getting warmer, drier and there will be more precipitation and floods (interviews 15,16,19,20). However, translating this definition into measures meant choosing certain climate adaptive topics. The four climate adaptive strategies contain the following regional climate adaptive projects that will be implemented the upcoming years;

- Waterpanel Noord: focus on adapting schoolyards, climate adapt business parks and include social housing corporations (interview 15).
- Maas- and Mergelland: exclusively chose to resolve water nuisance bottlenecks which consisted of a top 10 of water nuisance bottlenecks within the region (interview 20).
- Parkstad: focusses on the Woonwijzerwinkel to inform and advice inhabitants and wants to emphasize heat stress related measures (interview 16).
- Westelijke Mijnstreek wants to solve the water nuisance bottlenecks first and later wants to implement climate adaptation at a street or neighborhood level (interview 19).

These strategies get updated every six years to reassess the climate adaptive topics, bottlenecks and future measures. In updated versions other measures could be implemented within new rounds of funding. Apart from these area specific measures the municipalities and regions have all indicated to include climate adaptation in their rules and regulation, have agreed to include climate adaptation within all new spatial projects and continue the disconnection of the sewage subsidy (interviews 15,16,19,20).

Aligning the discourse category with the policy instruments

The main alignment of the discourse to the policy instruments is the *definition of climate adaptation* at the national level which has caused several effects in the current policy mix. The definition of mainly focusing on flooding, water nuisance and drought had the effect of less priority being put on heat stress and green related policy instruments. This can be observed in the information and communication instruments, the organizational instruments and within the economical instruments, where heat stress and green related measures are under organized and represented, do not have as much information and communication tools and have fewer and less structural options for funding. This proved to be one of the main fundamental issues within the policy arrangement which has to be improved on a national level in order to implement more non-water related measures in the policy instruments.

5.1.2 Actors

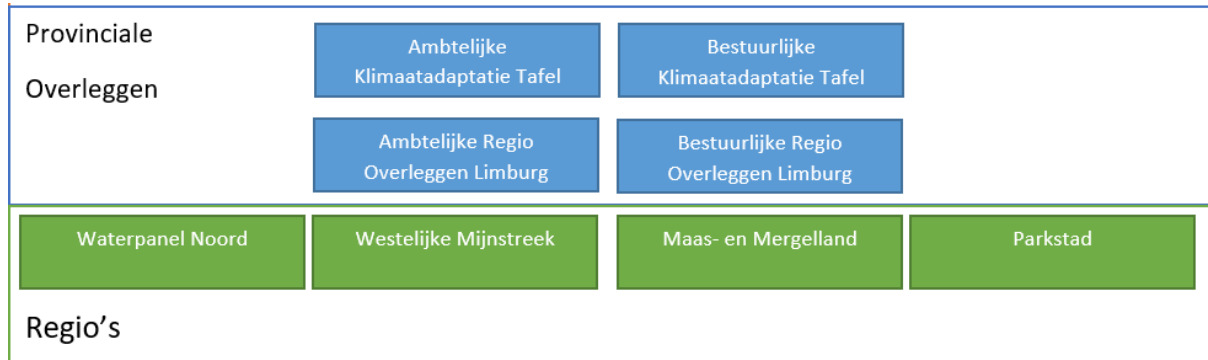


Figure 7: Most relevant actors in climate adaptation (own work)

Climate adaptation exists of various actors that form coalitions. These coalitions are involved in the decision-making and implementation of climate adaptation. As mentioned before, climate adaptation is a mostly water dominated policy domain which is subdivided in several different goals such as drought, flood protection and spatial adaptation. These separate goals often have separate meeting systems and actor coalitions which create an extremely cluttered policy domain (interviews 4,6,7,8,16,20,22). Actors that cooperate in most of the different coalitions are the province of Limburg, the water authority Limburg, the municipalities, WML and WBL. This paragraph will elaborate on the most important actor coalitions, its roles and the improvements within this structure.

Provincial level

At the provincial scale there are multiple meetings and actor coalitions. The most important one regarding climate adaptation is the Ambtelijke Klimaat Adaptatietafel Limburg and its administrative version. The water authority organizes these meetings and invites many other stakeholders such as the water company, Staatsbosbeheer, Prorail or the LLTB. All topics regarding provincial climate adaption gets discussed here (Observation 1). Next to this coalition the AROL and BROL meetings were created to discuss the urban sewage system. These meetings are more of a technical nature and are a way for municipalities to ask more complex and technically detailed questions about the sewage system (Personal communication, 2021). These partnerships consist of municipalities, the water authority and the water purification and supply companies (observation 1, interview 5).

Regional level

On a regional level the regional water cooperation's are the most important coalitions who cooperate on all water related subjects including climate adaptation. These are partnerships that have existed for more than a decade and got the extra task from the DPRA to adapt the space and environment to a changing climate (interview 15). As mentioned before, there are four water regions which each contain the municipalities, the water authority Limburg, WML, WBL and since recently the province. There is a civil and administrative version of this cooperation in each region. At the regional level the municipalities work on the stress tests, risk dialogues and implementation programs which later have to be adapted into local versions (interview 15).

Multitude of meetings leads to an overburdened system

An often mentioned obstacle is the multitude of different meetings and different panels. Respondents mention the increased level of difficulty in the water domain resulting in various different programs and meetings that overlap one another which leads to an overstructured and

overburdened meeting system. There are actor coalitions for spatial adaptation, the Meuse and flood protection, the regional system, drought, inter-provincial meetings with Brabant and a recently added coalition for water safety in relation to the recent flooding. Municipalities argue the different subjects are all connected to each other and cannot be implemented separately. Therefore an attempt should be made to simplify and merge the structure of the meetings (Interviews 4,5,6,8,13,16).

“I think the whole water world is hugely over-organized at the moment. I can't see the wood for the trees anymore because there are so many meetings that overlap. There is also a lot of administrative bustle. Therefore we should create an uniform structure together.” – Municipality of Maastricht (6:153)

Roles

The roles within climate adaptation formerly got divided in climate adapting the urban area and climate adapting the rural area. Traditionally, the water authority and the province have focused on the rural area and the municipalities on the urban area (interviews 5,11,26). Recently, this division of roles has been partially let go. Climate adaptive projects often overlap or influence one another and each government needs the others' cooperation. The water authority emphasized their role lies mostly within the rural area but measures taken in the rural area affect the urban area and vice versa for the municipalities (interview 17).

Role of province considered insufficient

An important research finding is the relatively small role of the province in climate adaptation. The province has formerly only implemented climate adaptation in the rural area. A bigger role is expected from the province in the urban area by almost all municipal respondents (interviews 2,6,8,13,14,19,20,25). The increased municipal workload for the municipal water civil servants have caused a need for the province to take over some tasks or projects that can be arranged, and add value for municipalities, at a provincial level. Examples could be creating a provincial strategy for climate adaptation in the urban area, to embed climate adaptation in provincial regulation, or to create climate adaptive urban programs such as collectively climate adapting business parks (interviews 8,14,19,20,25).

Not expanding the role of the water authority

Next to the climate adaptive coordinators, the water authority has a prominent and directive role in the regional water cooperation's. The water authority is traditionally an implementing government which has a water related scope. Municipalities express the need for the province to take over this directive role as the water related scope has become too narrow for climate adaptation. The municipalities want to include several other measures that include spatial planning. This better suits the more elaborate instrument tool kit of the province (interviews 16,23). Secondly, the province can create more uniform policy, rules and regulation which is a goal many municipalities are currently working on (interviews 16,17,23,25). During the internship a separate report was written about how the province could improve their role in the urban area, which can be found in appendix B.

Other stakeholders

Finally, next to these actors and coalitions other important actors to mention are the national government and the different ministries (mostly I&W) that have a big impact on national climate adaptive policy and decide the terms and conditions for the Impulse arrangement DPRA. Other stakeholders could be any stakeholder holding an interest in climate adaptive projects. Stakeholders

could be inhabitants, businesses, project developers, farmers, nature organizations or housing corporations (interviews 15,16). Most stakeholders have a role to climate adapt their own property or cooperate with governmental projects (interviews 7,13,26).

Aligning the actor category with the policy instruments

The biggest impact of the actor category on the policy instruments is *the currently insufficient role of the province of Limburg*. Provincial human capacity and financial resources are needed for climate adaptation. When comparing the capacity to the province of Noord-Brabant (1,5 fte and 1,5 million in Limburg vs. 10 fte and 19 million in Noord-Brabant) the lack of provincial implementing power becomes apparent (interviews 1,3). This results in less climate adaptive projects being implemented in Limburg than in Brabant. Second, *the fragmentation of climate adaptation* becomes apparent in the multitude of meetings and actor coalitions which caused water civil servants not being able to attend all of the meetings. Therefore important information is missed and the water civil servants are not always up to date which can cause delays within the implementation of the policy instruments (interviews 6,21).

5.1.3 Resources

Resources are defined as the means that actors have at their disposal or can mobilize to realize ambitions. The resources can be divided into three categories: *financial resources*, *human capacity and knowledge and expertise* (Veenman, Liefferink & Arts, 2009).

Human capacity: no civil servants to coordinate projects

Climate adaptation is still a relatively new subject in the province of Limburg and therefore still needs to claim its spot within the existing policy field. Climate adaptation is often the task of the water and sewage civil servant and sometimes gets included with the green civil servant (interviews 15,16,19,20). Most of the time climate adaptation is not included in the hours of these civil servants, resulting in a lack of time to keep up with all the meetings, educating themselves about climate adaptation and not being able to direct climate adaptive projects (interviews 10,13,15,16,19,20,25). Municipalities want to solve the problem by asking their municipal administration and council for more hours regarding climate adaptation. When these hours are granted, however, it is still hard to find new employees, especially technically trained employees that are able to perform the water civil servant duties (interviews 8,11,26).

Human capacity: province should invest more human capacity

The province of Limburg experiences similar problems in shortage of hours and is also having trouble recruiting new employees. They would like to set up a cooperation with universities and colleges to recruit new staff (interview 8). The province has, in comparison to the two neighboring provinces, limited human capacity. The province of Noord-Brabant for example has 10.0 fte to work on climate adaptation (interview 1) and the province of Gelderland has got 5.0 fte to work on the subject (interview 2). Meanwhile the province of Limburg only has 1,5 fte to put into climate adaptation, which implies their human capacity and capacity to direct programs and projects is limited (interview 26).

Human capacity: water authority

The water authority has, in comparison to the other two governments, multiple civil servants working on climate adaptation (interview 17). It is difficult to pinpoint how many fte are working on climate adaptation as this subject is often combined in the functions of multiple water authority civil servants. They still experience this as a shortage of hours and staff in comparison to the increasing climate adaptive tasks and bottlenecks. The water authority experiences difficulties as well to hire new employees (interview 17).

Financial resources

There are multiple financial resources that can be used for climate adaptation. The most implemented financial resources are subsidies granted by different organizations or governments, the sewage tax of municipalities, and the national climate adaptation impulse arrangement (DPRA). The higher level governments, such as the province and the national government, provide financial incentives for climate adaptation. The water authority finances municipal projects as well when the goal of the project has overlapping interests with the water authority's. Other stakeholders that invest are for example the Parkstad Region, the IVN or the Stichting Ark. Which budgets and subsidies exist will be elaborated on in the economical instruments paragraph.

Compartmentalization of budgets leads to a bureaucratic system

The water budget is quite extensive at all three governmental levels, but funds and budget being targeted at climate adaptation is often subdivided in smaller goals. Subjects such as drought, water nuisance and flooding often have their own program and their own budget even though the themes influence one another (interviews 9,17). An example is the DHZ that is targeted at drought solutions, the HWBP that is concentrating on water safety and prevention of flooding, or all the separate subsidies targeted at a different way of farming. This system increases the bureaucracy and administration for municipalities or other stakeholders that use these budgets or subsidies. When one project complies with several different budgets it is advised to only use one, as it is, as experienced by the municipalities, nearly impossible to track which part of the project contributed to which goal and doubles the administration afterwards (interviews 9,13,24). The municipalities would therefore want to request the national government and the province to combine these subjects into one climate adaptive arrangement that can serve multiple climate adaptive solutions (interviews 13,16,24,25).

Investment costs are high

The water measures to reduce drought and water nuisance are generally very expensive measures. Prominent examples are the separation of the sewage system which will take decades to be replaced, the room for the brook projects to reduce drought where plots of land sometimes have to be purchased and rearranged to a more nature based environment, or reducing water nuisance by sometimes unavoidable technical measures such as stews, dams or dykes, which are often costly (interview 17,22). Because of the high costs not all bottlenecks can be solved at once but will be phased in time. The water domain has traditionally received various sources of funding. Progress in implementing water related measures is therefore not perceived as a problem of a shortage of funding, but as a theme that will need time in order to become climate adaptive (interviews 6,13,23). This can be perceived as a lock-in situation that has been created by past decisions. For example, by implementing the sewage system using depreciation periods that last 60 years, it will take a significant amount of time to be able to completely replace this system (interview 23).

Knowledge and expertise

Even though climate adaptation is still a relatively new subject, plenty of knowledge has been gained in recent years. Research got conducted on a few different scales, which goes from large scale research such as the IPCC reports to the smaller scale research at neighborhood level. Plenty of knowledge has been conducted within drought, water nuisance and flooding. The biggest knowledge lacuna exists within heat stress (interviews 7,19,23). This could possibly be explained by higher governmental levels not perceiving heat stress as a priority and see it as a municipal task (interviews 9,26).

Measure related research

Next to the knowledge lacuna, the newness of climate adaptation means plenty of new measures still need research and background information. Examples are including climate adaptation within performance agreements with the social housing corporations, how climate adaptation can be best implemented in rules and regulation or if taxes should be implemented to convince inhabitants to climate adapt their property. These kind of researches will have to be conducted in the future as they are necessary for future decisions (interviews 16,17,23). These are mostly measures which need to be implemented at a municipal level and therefore municipal research is necessary.

Physical features

The resources physical features and space for climate adaptive measures are additional factors that should be included within the conceptual model of the policy arrangement in order to create a satisfactory theory. The physical features proved to have an effect on the amount of climate bottlenecks in an area and how high the costs will turn out (interviews 6,10,18,23).

1. South of Limburg contains more water nuisance bottlenecks

In the south of Limburg climate adaptive water measures are more expensive than in the north of Limburg because of the physical features. This area consists of more water nuisance bottlenecks which are, most of the time, more complex to solve because of the hilly terrain and the type of soil (interviews 6,10,18,23). Water nuisance bottlenecks in this area need bigger infiltration measures because the soil does not absorb water as easily, and need more flood preventing measures because water quickly gathers in the valleys. Another typical trait of the south of Limburg is the mining history, which causes extra attention put upon possible groundwater level rise because of the murky water situated in the mining tunnels (interview 16). A third example is the use of the landscape in south of Limburg which has a cultural status, meaning it cannot be altered too much for water related measures (Uitvoeringsagenda Maas en Mergelland, 2021).

2. North of Limburg contains more drought bottlenecks

The north of Limburg is more prone to drought because of the sandy soils. It therefore contains more drought related bottlenecks. These bottlenecks require other measures than in the south of Limburg (interviews 4,13,19,23). An example is the 'Room for the Brook' project of the water authority which especially thrives well in the north of Limburg because of the sandy soils easily absorbing water. The water nuisance measures are less invasive and in reduced numbers in the north. An example is the disconnection from the sewage which in a northern Limburgish rural municipality might require only cutting the downspout, while in a southern Limburgish urban municipality might require building a substantive infiltration facility (interview 18).

3. Space for climate adaptive measures

Another important feature is the density and the size of the urban area. When there are a lot of different spatial functions combined into one area, such as the cities of Roermond and Venlo, it is difficult to create space for climate adaptive measures (interview 8,25). Solutions will have to be combined with other spatial interests, such as parking and infrastructure, which makes the process more difficult to implement as other domains and interests have to be convinced to use the space for climate adaptation (interviews 8,25). Rural municipalities have found it easier to implement climate adaptive measures (water buffer, wadi etc.) as space for measures is often nearby (interviews 7,10,24). Therefore space for climate adaptive measures is an important indicator for the measures which are possible in the area, as well as the severity of heat stress and the success of certain subsidies (interviews 8,25).

Aligning the resource category with the policy instruments

The resources were found one of the biggest contributing factors of fundamental causes which eventually result in not being able to optimally implement policy instruments. One contributing factor is the *shortages within human capacity*, this causes the inability to direct projects or implement policy instruments by the governments themselves. Therefore part of the process has to be outsourced or otherwise reduced in process costs. In some cases this was not possible resulting in climate adaptive budget being unutilized because there was no more budget for the process costs.

Secondly, the lack of human capacity caused water civil servants not being able to educate themselves, keep up with the over-structured meeting system and therefore not being up to date. This results in miscommunication which also hinders the implementation of policy instruments.

Secondly, two factors can be recognized within the resources; *a path dependent water system and high costs for water related measures*. These two factors lead to a lock-in situation. Because of the high costs for both big water bottlenecks and replacing the sewage system, investments can only be done in moderation. Climate adaptation is financially seen as a linking opportunity, referring to other climate adaptive measures such as trees, creating shade or building differently will all be dependent on the pace of the water measures. Therefore climate adapting the public space might take another 60 years.

In addition to green or heat stress related measures another factor is an *uncomplete overview of the measures: effects, costs and benefits*. The costs, benefits and effects of mainly heat stress related measures are currently unknown. This results in these measures not being implemented in the current policy instrument mix which is mostly water dominated.

The final factor are *physical features of the environment*, which has an effect on the policy instruments' content and effectiveness. The south of Limburg has lower goals for climate adaptation which has an effect on the terms and conditions in many rules and economical instruments (interview 16). The higher goals applied in the north of Limburg are often perceived as unachievable and unaffordable in the south of Limburg (interview 26). An example is the lower flood standard in the south of Limburg or the lower amount of millimeters for rainwater storage. Therefore the south of Limburg is less well protected against climate change than the north of Limburg which can result in increasing damage in the future.

5.1.4 Rules of the game

The last dimension focusses on the rules of the game which contains the *political culture, procedures and legislation* relevant to a particular policy domain (Veenman, Liefferink & Arts, 2009). Climate adaptation is a very broad topic spreading across many different fields and interests. This makes it a difficult subject to frame or regulate. The rules of the game and procedures are therefore, at the moment, not well aligned. By national law the regions and municipalities are enforced to act climate adaptively and to work following the Delta Program Spatial Adaptation which includes stress tests, risk dialogues and regional implementation agendas (Implementation program Horst aan de Maas, 2022). The province is also required to implement climate adaptation on a provincial level, has to conduct its own stress tests and risk dialogues and has to act in a climate adaptive manner (interview 26).

Provincial politics

Climate adaptation has not received as much political priority in the province of Limburg. The provincial government has been politically dominated by the Christian conservative party CDA. Their political stance towards climate adaptation has been somewhat reluctant when compared to other provinces such as Noord-Brabant and Gelderland (interviews 1,3). Noord-Brabant and Gelderland have, for example, made climate adaptation one of their main focal points and themes in their environmental visions. The province of Limburg has not done this. The municipalities and the neighboring province of Noord-Brabant express that the province of Limburg is not prioritizing the subject as much as it should and requested a bigger role (interviews 2,6,8,13,14,19,20,25).

Politics in municipalities and water authority put more essence on climate adaptation

The political coalitions within the Limburgish municipalities and water authority have been more traditional and right winged as well. At the municipal scale the more local political parties are frequently situated within the municipal councils (interviews 7,13,14). However, this does not result in less priority being put on climate adaptation as many municipalities have included climate adaptation as one of the focal points within their sustainability visions (interviews 14,15). The water authority Limburg has prioritized climate adaptation as well, emphasizing it is one of their most important goals which is included in almost all of their programs (interviews 17,18).

Procedure: stress tests, risk dialogues, implementation program

The noticeable procedure within climate adaptation has the following order: stress tests, risk dialogues and implementation programs. Firstly, the regions and municipalities perform stress tests which provides maps of their region within the four climate adaptive topics: flooding, water nuisance, drought and heat stress. The stress tests are first conducted at a regional level and are later translated to municipal maps. The municipalities have to filter their own bottlenecks next to the regional bottlenecks or projects (Waterpanel Noord, 2021; Maas- en Mergelland, 2021).

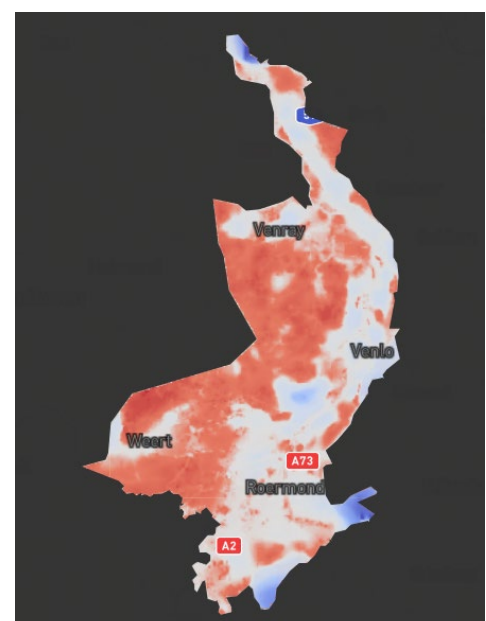


Figure 8: Stress test drought Waterpanel Noord (n.d.)

Secondly, the region will organize risk dialogues with stakeholders such as the LLTB, the water authority, social housing corporations or the nature associations. These will be more externally orientated and, depending on the regions strategy, will either focus on climate adaptation as a whole or on the bottlenecks the region is planning to solve within this implementation program. On a municipal level these risk dialogues will be held again. Some municipalities chose to do this internally with the other domains within the municipality. Others chose to incorporate other stakeholders (interviews 8,13,24,25).



Figure 9: Route risk dialogues, *Klimaatadaptatieportaal* (n.d.)

Finally, the implementation programs get formed, both on the regional level as on the municipal level. The content of these regional implementation programs varies greatly. Some regions only include their biggest bottlenecks while others chose to include every aspect of climate adaptation. This makes the process and the implementation program very adjustable to the local situation as some of the regions chose to solve their biggest bottlenecks first, but also has the disadvantage that not every subject has to be included (interview 16). Thus far these regional adaptation strategies are the only policy strategies specifically designed for climate adaptation and therefore a highly necessary instrument.

Need for frames and regulation

All of the regional adaptation agendas included the intention to establish frameworks for climate adaptation. The main reason for implementing regulation is the lack of success to include climate adaptation by other stakeholders or even within other departments in the province or municipalities (interview 23). Project developers may try to avoid climate adaptive measures because of the higher costs of building or the need of space for these kinds of measures. Other departments in the municipality or province can object to climate adaptive measures as well because of diminishing land values (interview 25). When space gets used for green or water related measures instead of buildings or other functions the land value decreases. Without climate adaptation being legally embedded it is hard for the province or municipalities to ensure climate adaptation within new projects (interviews 7,8,18,19,25).

Discussions about regulating climate adaptation

What is the best or preferred way to embed climate adaptation is a discussion within the various governments. Most governmental levels want to include rules, standards or building covenants in order to embed climate adaptation. A main point of discussion is at which governmental level climate adaptation should be regulated. There was not one answer or conclusion to this question. Some municipalities would prefer to have one provincial standard, building covenant, green percentage or sewage tax (interviews 8,16,17,19,23,25) while other municipalities prefer keeping these decisions at a municipal level (interviews 4,6,13,14,24). The province and water authority Limburg have a preference to regulate climate adaptation at a provincial level in order to form uniform policy and prevent competitiveness between municipalities (interview 18,26). There has not been a decision about how to regulate climate adaptation yet which results in climate adaptation remaining a relatively unregulated and unframed subject that therefore lacks 'the big stick'.

Aligning the rules of the game category with the policy instruments

At the moment the three governmental levels all realize *climate adaptation is too non-committal* and therefore other stakeholders do not comply with including climate adaptation (interviews 15,16,18). Governments are slowly starting to research manners to rule and regulate climate adaptation. This has resulted in a multitude of possible instruments and ideas. Even though there are plenty of options to include climate adaptation especially the municipalities do not seem close to making a decision. Therefore the climate adaptive policy arrangements remains unstructured with mostly water related rules in provincial, municipal and water authorities regulation.

5.2 Alignment between the policy arrangement and the policy instruments

To answer the second research question about the alignment between the policy arrangement to the policy instruments, the factors influencing the policy instruments have been summarized in the table below. These factors contribute to policy instruments not being able to function optimally and contribute in various degrees to the malfunctioning of policy instruments.

Factors from the policy arrangement	Has an impact on:
Definition of climate adaptation on a national level	<p><i>Information instruments:</i> water related discourse is noticeable. Instruments mostly focus on water related measures.</p> <p><i>Organizational instruments:</i> climate adaptation is being organized within the water department.</p> <p><i>Economical instruments:</i> funds is mostly available for the three main themes in the definition.</p>
Fragmentation of the actors and resources	<p><i>Information and communication instruments:</i> civil servants miss information and communication about climate adaptation because of the overstructured policy domain.</p> <p><i>Organizational instruments:</i> more difficult to structure the actor coalitions and create one climate adaptive team.</p> <p><i>Economical instruments:</i> the fragmented resources are hard to combine and the creation of synergies to work towards the main goal of a climate adaptive environment is highly complex.</p>
Lacking role of a higher level government (province of Limburg)	<p><i>Economical instruments:</i> less resources and human capacity from the province to direct or co-fund projects which leads to fewer climate adaptive projects.</p> <p><i>Legal instruments:</i> currently no provincial rules or regulation for climate adaptation exist besides water regulation.</p>
Shortage in human capacity	<p><i>Organizational instruments:</i> limited capacity to direct projects or keep up with the different meetings.</p> <p><i>Economical instruments:</i> limited capacity to implement subsidies by the municipality themselves. Leading to high process costs and an insufficient subsidy system.</p>
High costs for water related measures	<p><i>Economical instruments:</i> investing in solving bottlenecks and rainwater sewage can only be done in moderate amounts.</p>
Path dependent sewage system	<p><i>Organizational instruments:</i> climate adaptation is perceived as a linking opportunity and therefore dependent on the pace of the replacement of the sewage, which therefore becomes a slow process.</p> <p><i>Economical instruments:</i> high investment costs created the path dependent system that cannot easily be diverted from. Replacing the sewage system will probably take another 60 years.</p>
Uncomplete overview of the measures: effects, costs and benefits	<p><i>Information and communication instruments:</i> the information instruments miss the inclusion of heat stress related measures which causes a lack of knowledge for other instruments.</p> <p><i>Economical and legal instruments:</i> The uncomplete overview results in there being no base of effects, costs and benefits to make a decision about how and in what manner to include heat stress related measures.</p>
Unregulated policy domain	<p><i>Legal instruments:</i> except for water related rules no climate adaptive rules or regulations are currently in use.</p>
Physical features of the environment	<p><i>Economical instruments:</i> higher costs for measures and therefore higher budgets / subsidies are necessary in the south of Limburg.</p> <p><i>Legal instruments:</i> lower standards for the south of Limburg because of higher costs for measures.</p>

Table 9: Factors of alignment

5.3 Policy instruments

Policy instruments can be used to achieve certain goals. Governments have an array of different policy instruments they can implement to achieve a climate adaptive environment. Within this chapter the current policy instruments will be analyzed, which policy instruments can be improved and if there are certain policy instruments missing.

5.3.1 Information and communication instruments

Understanding is the first phase in the policy process which contains the problem detection and awareness raising resulting in an initial problem framing. Information and communication instruments are often the first implemented instruments which provide the base for the other instruments (Henstra, 2016).

Research

The first step in the policy process is to gain information about climate adaptive issues. There are a few stakeholders that supply plenty of research regarding climate adaptation. The biggest research serving as a base for climate adaptation within the province of Limburg is the LIWA research (Limburgs Integraal Watersysteem Analyse). This research contains future climate adaptive scenario's concerning the water system and accompanying measures (interview 26). Other research for future climate related issues are the KNMI rapporten (interviews 8,19). These rapporten are necessary information in order to predict to what extent the climate is going to change and therefore which measures will be necessary to become climate adaptive. Finally, the water authority provides multiple sources of knowledge. These are always water related and are sometimes more of a technical nature. An example is the 'Water in Balans' program consisting of several pilots. These pilots are aimed at discovering how to maintain or create a water system that is in balance. The balance refers to drought and water nuisance being significantly reduced (interview 17).

Municipal research: stress tests

At the municipal level the more local, project based, research got conducted. All municipalities were, in the first place, obligated to perform stress tests to identify the climate bottlenecks. The survey showed 85% of the participating municipalities have conducted their stress tests. These stress tests can be used within future spatial plans to prevent or adapt building at vulnerable places.

The next step is to identify the prone areas within the municipality. The data conducted in the stress tests is mostly primary data that has to be combined with extra information such as the function of an area. Only 67% of the municipalities mentioned to perform this step. An example is to locate where vulnerable groups such as a retirement homes or kindergartens are situated and try to prevent heat stress in this location. Municipalities mention they perform this step usually only when projects are going to be implemented and mostly do not pick new projects solely based on the stress tests (interviews 10,24). Municipalities mention the stress tests mostly get used as a discussion board within new spatial plans to inform other civil servants about the risks (interviews 6,24,25). Most of the time the water or drought bottlenecks were already known, but because of a limited budget, high investment costs and a lack of human capacity were not implemented yet. With the DPRA, new funding comes available and these already defined projects get a chance to be implemented (interviews 6,8,10,22,24).

Waterinlimburg.nl; knowledge sharing between municipalities

The municipalities also spread knowledge about climate adaptation and inform other municipalities or stakeholders. Within municipalities knowledge portals and websites exist where municipalities can

provide and extract knowledge about their own experiences (interviews 13,14,15,22). The website waterinlimburg.nl is an online portal for municipalities to share their water related experiences and publish knowledge on this website. To use the website is, however, an extra step civil servants have to take and have to create time for in their schedule. Some civil servants expressed not having the time to read all of the information on this portal. Secondly, not every civil servant was aware this website exists, especially outside of the water domain as it is mainly focused on water related topics, or does not check it regularly (interviews 6,22). Therefore knowledge is not always optimally shared because of a lack in human capacity and civil servants not being able to keep up. An example is the project Waterpanel Noord has started within their region to educate pavers and gardeners about climate adaptation. The municipality of Sittard-Geleen wants to start a similar project and could learn, or even copy, some of the knowledge already acquired by Waterpanel Noord (interviews 15,19).

Waterklaar; the main communication instrument in Limburg

Waterklaar is a Limburg-wide communication instrument for climate adaptation. This is a partnership between all Limburgish municipalities, the province, the water authority Limburg, knowledge institutes and some of the biggest gardening companies in the region (interview 14). Waterklaar is the main communication instrument to communicate climate adaptation with inhabitants. The communication instrument consists of a website and promotion material (www.waterklaar.nl). The website serves as an information space where inhabitants can get informed about climate adaptation, which measures can be implemented and which subsidies can be used in their municipality (interview 14).

Next to the website the project also provides a communication toolkit for the municipalities. This toolkit consists of written pieces of text to use in the local newspaper, climate adaptive cartoons and banners, and signs to use during sustainability markets. Municipalities can use this toolkit in their own communication strategies (interview 14). Waterklaar is a well-used platform. Following the survey, 85 percent of the respondents have used Waterklaar in their communication strategies.

Another communication instrument more effective?

A discussion in the southern regions arose about the uncertainty if this website is actually reaching all inhabitants, or if it is reaching only the inhabitants which would have climate adapted their property anyway. Waterklaar uses its own social media where it has not received a tremendous amount of popularity and only has a limited amount of followers (interview 16). The question is if this platform should get an impulse, or if communicating about climate adaptation should be organized in a different manner. Waterpanel Noord is the founder of the platform and will probably want to maintain this platform. However, in the Parkstad region, the discussion arose to create a different communication system by combining climate adaptation with other linking opportunities such as the energy transition communication instruments (interview 16).

“Is Waterklaar the plan we want to use to reach our citizens? I can also use the Woonwijzerwinkel to reach my citizens under a one stop shopping principle; than I have everything there at once. The Woonwijzerwinkel has much more followers on social media than Waterklaar, which only has 400 followers or so. Those are probably all civil servants. So we are critical to see if this is the tool we want to use to reach the citizens. However, the platform has done a good job and there is a nice product at the moment. So we don't want to start throwing that away quite yet.” – Parkstad region (16:138)

External risk dialogues versus internal risk dialogues

The risk dialogues form a big part of the communication of municipalities and regions with other stakeholders. The survey showed only 63% of the respondents have already organized a risk dialogue within their municipality. Risk dialogues can be implemented in various ways. The external risk dialogues, where municipalities want to include external stakeholders to solve a climate adaptive problem, were found to be inconclusive when only conducting one or two dialogues. Because of the complexity of many climate adaptive bottlenecks multiple rounds were necessary to actively include external stakeholders and form a strategy to solve the bottleneck (interviews 13,22). However, other stakeholders often did not participate in multiple dialogues and dropped out (interview 22). The municipality of Roerdalen mentions the reason could be the multitude of regional risk dialogues, local dialogues and having to repeat these dialogues multiple times, wherein stakeholders have to participate voluntarily (interview 22). Therefore this instrument is somewhat too non-committal to include external stakeholders to form a strategy and mostly only creates awareness about climate adaptation amongst external stakeholders (interviews 16,19,22).

Internal risk dialogues

Another strategy to implement the risk dialogues is by conducting them internally. The internal risk dialogues mostly contain discussions about including climate adaptation in other policy domains (interview 24). These internal risk dialogues, however, are no guarantee that other policy domains will include climate adaptation in their daily practice, as the survey showed climate adaptation barely gets implemented in other civil servants' daily tasks such as procurements (25%) or tenders (15%). At the moment most municipalities in all four regions have conducted an internal risk dialogue but the majority have not conducted external risk dialogues yet (interviews 21,24,25).

These two types of risk dialogues work towards different goals. The external risk dialogues with other stakeholders improves the involvement and awareness of other stakeholders and wants to work towards an area-guided strategy. While the internal risk dialogues seeks to improve awareness about climate adaptation within the municipality. Ideally both types of risk dialogues should be held regularly to increase the awareness.

Missing information within heat stress

As mentioned before, within the existing information instruments the biggest lack of knowledge has been in heat stress. There has been plenty of research conducted about the water system and which measures are necessary to influence the water system to become climate adaptive. However, heat stress is often overlooked in these studies (interviews 7,13,16,19). Municipalities foremost mention this lack of knowledge as they have the biggest responsibility within the urban area where heat stress is most common. Factors such as the influence of wind in a street, the effect different materials have on the temperature, and the benefits of lowering the heat stress are still unknown to the municipalities (interviews 7,13,16,19). Therefore more research is necessary within heat stress related subjects.

A system of key numbers and indicators to create a climate adaptive measure structure

A few municipalities mention they would want to adopt a core numbers and indicators system to structure the climate adaptive measure decision making. Firstly, the key numbers of all the different climate adaptive measures have to be attained, referring to the effect of the measure, the costs of the measure and the benefits of the measure. Then a structure has to be applied, which municipalities mention is most practical in the form of a route or a table. This structure can then be

used to motivate climate adaptive measures in spatial plans (interview 7, observation 5). At the moment, deciding which climate adaptive measures get included in the spatial plans is done by intuition. A guideline could help to use these measures in a cohesive way amongst municipalities (interviews 7,25). However, not all information is available to create this system as the knowledge lacuna in heat stress and green measures has to be solved first.

“Key numbers for the design of public spaces can really help to motivate your spatial plans and you can base your arguments upon. How you design a public space right now depends a bit on coincidence.” – Municipality of Venlo (7:68)

The province has recently finished the disconnection of the sewage table where such a guideline is implemented for disconnecting from the sewage measures. This instrument is missing the green and heat stress related measures which should be included in order to create a climate adaptive guideline.

Miscommunication between governmental levels leads to complicated policy instrument implementation

The communication between the three governmental levels could be largely improved. An important observation during multiple meetings with the water authority, the province and the municipalities is the miscommunication between the three governments (observation 1 and personal communication, 2021). An example is the continuation of the disconnecting from the sewage subsidy which used to be a partnership between the water authority, the province and the municipalities. The province mentioned they were not aware this arrangement got renewed and did not incorporate financial budget for the renewal of the arrangement (Personal communication, 2022). Another example is the communication about the one million trees plan where municipalities were somewhat misinformed by the province about the terms and conditions to receive the subsidy. The terms and conditions changed during the process which was communicated too late and caused confusion within municipalities (interviews 8,24). One last example is the renewal of the Keur of the water authority where changes were made to ensure millimeters of water retention in new spatial plans. Municipalities discovered this new rule when the new Keur was already published (interviews 17,23). This results in more difficult processes of implementing policy instruments as which terms and conditions or regulations will be applied becomes clear in the implementing policy stage or after a project is finished. When communicated beforehand, more deliberate decisions could have been made by governments (interviews 6,10,15). Governments can then, for example, take the new subsidy into account within their budgets or discuss new regulatory instruments together.

Reducing pavement and encouraging green measures

Finally, municipalities can promote various actions to improve green and destone private property. The greening of private property and destoning actions can improve the climate adaptability within the urban area. The survey showed only 30 percent of the municipalities promote the destoning of private property or including green measures. Ways of promoting destoning is participating in the NK-tile swiping competition or having a local action to collect tiles for free. Examples to promote greenery is by providing online gardening courses, create a partnership with garden centers to promote climate adaptive gardening, or create a discount for plants that improve the biodiversity. The inclusion of green measures is an improvement many municipalities recognize. Because of the more difficult economic circumstances in the past many municipalities were only able to implement these kind of communication actions in reduced numbers. Currently, the financial circumstances in many municipalities have improved and more room for these kind of measures will become available (interviews 6,19,25).

5.3.2 Organizational instruments

Governments can invest in making their own property climate adaptive and educate their own staff about what they can do to implement climate adaptation (Henstra, 2016). This will ensure the inclusion of climate adaptation within the governmental organizations. Next to implementing climate adaptive measures, the organization of climate adaptation within the governments proved to be an important factor. Within the three governmental levels climate adaptation is placed in the water department and therefore the water civil servants mainly implement climate adaptation (observation 1, personal communication 2021).

The need for additional civil servants

On a municipal level the water civil servant works mostly on the theme climate adaptation. These civil servants are mostly active in the maintenance department of the municipality. Waterpanel Noord stated this could be a problem, as they get more caught up in daily maintenance tasks and have less time to invest in creating new policy. This forms an extra challenge as climate adaptation is a relatively new policy topic (interview 15). The solution would be to assign another, more policy focused, civil servant to climate adaptation. While this is still the intention of the region not every interviewed municipality has found the resources to implement this, resulting in unfinished or short local implementation agendas (interview 15).

Difficulty breaking the organizational barriers

In the other three regions they have experienced this water focus as well. Parkstad wanted to get ahead of this problem and set up a mixed regional team consisting of civil servants with different specialties of the different municipalities. Especially for climate adaptation, which is a broad topic, this ensured more diversity of the climate adaptive measures in the regional agenda and more usage of linking opportunities, with, for example, the energy transition (interview 16). However, the scope of the main source of funding (Impulse arrangement) is still mainly focused on water related measures causing problems later in the policy process, as the designed measures of this team were sometimes not applicable for the Impulse arrangement (interview 16). Therefore creating more encompassing implementation agendas is, even with a change of civil servants in the team, sometimes not applicable because of terms and conditions in economic instruments.

Implementing climate adaptation in new projects

Climate adapting the public property proved to be a key strategy for implementing climate adaptation within the governments. The prominent school of thought within climate adaptation is to link climate adaptive opportunities with other domains and interests. Overall, within new spatial plans or restructurings, climate adaptation does get a place within the project, resulting in space for green and blue measures in new housing projects, or expanding the sewage capacity in a street that often suffers from water nuisance (interviews 4,7,11,13,15,19,20,21,22,23). Following the survey 74% of the municipalities expressed to include climate adaptation in restructurings and building projects.

Changing an infrastructural system takes a lot of time

The downside of predominantly implementing climate adaptive measures by using linking opportunities of the replacement of the sewages and solving bottlenecks, is the amount of time it needs before climate adaptation is implemented in the majority of the urban public areas (interviews 4,13,21,24). This can result in climate adapting the urban area to take, for example, another 60 years because of the high investment costs (interview 6). Climate adaptation is therefore seen as a structural subject which will not be solved in the upcoming years (interviews 6,10,22,23,24,25).

“Towards the future you will have to convert the system which costs a lot of money and is going to take a very long time to adapt because you can't say we're going to replace all the sewers that are still there. The whole of Limburg would go bankrupt if we do that. So you adapt a small piece at a time. By tackling a small piece at a time you will eventually end up in a climate adaptive environment but it is a long-term process. In addition, you tackle flooding locations sooner where you can link goals, you tackle it sooner than somewhere where nothing is wrong.” – Municipality of Roerdalen (13:314)

Implementing climate adaptation in everyday tasks

What is more difficult is implementing climate adaptation in the everyday tasks of civil servants other than the water, green or infrastructure civil servant. These three sectors work on climate adaptation more frequently because climate adaptive measures have a relation with these three domains. The tasks for climate adaptation are relatively clear for these three domains but are less obvious for domains such as the energy transition, the land use planning officer or the procurement section (interview 15). Only 25% of the respondents indicated that climate adaptation is included within contracts and tenders and 15% included climate adaptation in their procurements. Because it is not exactly clear what actions these other departments have to take, and because the first priority of other departments does not primarily lie within climate adaptation, they are less aware or interested in investing time to discover what actions they could include in order to act climate adaptive (interviews 16,21). An improvement could be made by clearly formulating tasks other departments should implement in order to become climate adaptive. The region of Parkstad and the province want to conduct a research in order to discover these other linking opportunities (interview 16, personal communication, 2022).

Lessons from other governments

How to exactly organize climate adaptation is still a task for the several governments. Other governments such as the province of Noord-Brabant and Gelderland, which are both further along the process of implementing climate adaptation within their organizations, have two different strategies. The province of Noord-Brabant organized climate adaptation by creating one extensive climate adaptive team within the water department who direct and stimulate climate adaptation on a large scale (interview 1). The province of Gelderland has implemented climate adaptation in a slightly different manner and created a climate adaptive team operating in three different domains (agriculture, nature and landscape; housing and spatial planning; and water and area development) which facilitate different projects (interview 3).

Both the province of Gelderland and Noord-Brabant included climate adaptation as one of their main themes in their environmental visions in order to ensure climate adaptation in other departments. The idea behind the environmental visions is to include the main themes in the whole organizations' daily tasks and projects (interviews 1,3). Both provinces experienced, however, that this does not guarantee inclusion of climate adaptation in practice by the other clusters (interviews 1,3). The province of Noord-Brabant has therefore recently created an administrative order to include climate adaptation in all different clusters (interview 1). The province of Gelderland expressed an interest in following this example (interview 3).

Research linking opportunities should be applied in an administrative order

The province of Limburg has not included climate adaptation as one of their main themes in their environmental vision and the integration of climate adaptation within other clusters is therefore still minimal (personal communication, 2021). In order to ensure climate adaptation within the provincial organization the province could follow Noord-Brabant's example and implement an administrative

order, as it has been demonstrated by the other provinces this will not get implemented without an organizational instrument. This will be especially important for the province as it is a bigger organization with many different policy domains and civil servants (interview 1). Before this step can be taken it is important to first research the linking opportunities for climate adaptation in the other departments. This research can result in concrete actions that can be applied by the other departments (interview 1). Otherwise the risk exists the other departments will overlook climate adaptation again because of not knowing what actions to implement. An administrative agreement could be made afterwards to ensure these actions are being implemented.

A multi-disciplinary provincial team

A follow up step, when the linking opportunities are discovered, is to filter and include the most prominent departments such as spatial planning, green and nature, or infrastructure to work in a multi-disciplinary team creating a more encompassing climate adaptive strategy following Gelderlands' example. A necessary requirement in order to let the team function as optimally as possible is the decompartmentalization of the different budgets. As explained by the Parkstad case, eventually implementing these more encompassing measures are difficult to fit in the current budget structures, which eventually leads to climate adaptation still being mostly implemented within water and green (interviews 3,16).

5.3.3 Economic instruments

Economic instruments can be used in many ways to support climate adaptation. Instruments in this category generally involve the use of public funds to produce and maintain public goods and services, to induce targets to adopt policy-preferred behavior, or to impose costs on targets in order to discourage undesirable behavior (Henstra, 2016). There are multiple economic instruments that can be used for climate adaptation. The next paragraph will describe the existing economic instruments, its malfunctioning's and any missing instruments.

Investing in the public area

Governments can directly invest in climate adaption. The governments can invest in climate adapting the public space within the urban area, flood protection, in ecosystem management and in infrastructure (Henstra, 2016). There is a multitude of programs and projects that either have climate adaptation as their main investment goal or it is included as a subgoal. To maintain an overview, the most important forms of investing have been selected and will be elaborated on in this paragraph.

Room for the brook program

The water authority has created plenty of different programs to ensure flood protection and climate adaptation. The biggest program in the north of Limburg is the "Room for the brook" program where the brook can stream in its natural form which reduces drought and water nuisance. The water authority invests in, if necessary, acquiring land for the brooks, setting up the cooperation with the surrounding areas and eventually update the natural and water elements in the basin (interview 17).

Water in balance program

A second program is the "Water in Balans" program where a climate adaptive water system has to be acquired by performing different pilots in several areas. The water authority directs this program and invests in these pilot's measures together with other stakeholders, which most of the time have one complex climate adaptive problem such as drought or water nuisance (interview 17).

Area guided climate adaptive approach

One of the projects organized by the province are the two area-based approaches where two areas will have to become climate adaptive. These are the Peelen in the north of Limburg and the Geul area in the south of Limburg (interview 26). Area specific measures will be implemented to climate adapt these two areas. An example is the irrigation matter and drought which plays a more prominent role in the Peelen, and the water nuisance and flooding problems which play a more prominent role in the Geul area (interview 26).

Climate adapting investments of the municipality

The municipalities generally invest, as mentioned before, in climate adapting their own property such as public squares, creating green routes to and from the city, and slowly phasing creating climate adaptive streets. Every municipality that got interviewed has directly invested in climate adapting public property (interviews 4,6,7,8,10,13,21,22,24,25).

Subsidies

Subsidies are used to achieve a goal that has to be financially incentivized. These subsidies can be created by one government incentivizing lower level governments, or from one organization or government to incentivize other stakeholders (Henstra, 2016).

Climate adaptation gets more priority when there are subsidies available

Most municipalities express that when there is a budget or external subsidy available they are more inclined to work on these subjects. It gives the municipalities and its civil servants an argument for pressing these subjects to the foreground of their alderman and indirectly means support from another level of government for this goal (interviews 21,24,25). There are a few existing subsidies in this category: the DPRA impulse arrangement from the national government, the one million tree plan from the province, the disconnection from the sewage subsidy from the water authority and the DHZ-arrangement from the province.

DPRA Impulse arrangement

The DPRA Impulse arrangement originates from the Delta Plan Spatial Adaptation and is seen as the main form of funds for the regional and local implementation programs (interviews 15,16,19,20). The goal is to incentivize spatial measures which improve climate adaptation. After regions and municipalities have done their stress tests, risk dialogues and created their implementation programs they can apply for the Impulse arrangement. Each region has a set amount of funds that they can use within three rounds, starting in 2021. When a region does not apply one year the budget does not diminish. To apply for the funds the region or municipality has to have approval for their projects from the water authority or the province (Observation 1, interview 23). Overall the DPRA Impulse arrangement is perceived as a highly necessary investment from a higher level government. Most regions use this arrangement either for solving big bottlenecks or for selected climate adaptive projects spread across the region (interviews 15,16,19,20).

Heat stress is harder to apply for subsidy

The terms and conditions of this arrangement have been experienced as slightly problematic by municipalities for a few reasons. Because of the water dominant discourse the subjects that are available for the subsidy are water nuisance, flooding and drought. Heat stress is perceived as a linking opportunity that could be incorporated in the other three topics. Measures such as shade or water fountains therefore do not qualify for the subsidy (interview 16). This was perceived by multiple municipalities as a missed opportunity to encourage heat stress and green related measures (interviews 13,16,24,25).

Need for an incentive for green measures

Municipalities have expressed the importance of incentivizing green measures as these are often more difficult to get funded than the water topics (interviews 4,7,13,15,19,20,22,23,25). The last few years many municipalities have experienced difficulties in their finances. This mostly resulted in cutting back on green expenses because of the high maintenance costs. Secondly, green measures can sometimes not be funded by the sewage tax, which is one of the main municipal budgets for climate adaptation, when there is no linking opportunity with water related topics (interview 13). Municipalities would therefore want to request the national or provincial governments to provide a green incentive so municipalities can prioritize green measures and are more inclined to provide green spaces in the municipalities (interviews 19,21,25).

"It would be great when we wouldn't be the only one creating a budget for green measures but that we can also receive a budget from other governments. It shouldn't just be the responsibility of the municipalities. Greening the public spaces is a subject that municipalities are now facing alone. If you're realistic, we've been a municipality with real shortages of funds for years, then money for these kind of topics were not a priority. So you can only do that if your municipality is in a better financial position or when the urgency is felt. Otherwise, it's not going to happen." – Municipality of Venlo (25:348)

One million tree plan

The one million tree plan is a plan originating from the province to create more hectares of green and biodiversity. The original plan allowed municipalities and other nature oriented stakeholders to apply for subsidy for every plan that includes new square meters of trees. This resulted in many municipalities creating plans involving new trees and the subsidy becoming incredibly popular. The original budget which was available for the million tree plan was quickly overrun and later the terms and conditions got adjusted (interviews 4,12).



Figure 10: One million tree plan, Roumen (2021)

Changing the goal of the subsidy

The province later altered the goal to creating as many hectares of trees as possible and funding only 1 euro per tree. The idea behind lowering the budget per tree is to steer municipalities towards buying big parcels of land and create a forest upon these newly acquired lands by planting small shoots of trees (interview 12). The municipalities in the meantime created their own tree and forest related plans. Municipalities assumed they could get food forests or more mature trees subsidized to reduce heat stress. These are mature trees which cost 300 to 400 euros per piece, conflicting with the goal of the province to create as many new hectares of forest as possible within the budget (interview 12).

Miscommunication of changed terms and conditions created financial problems for municipalities

The new terms and conditions of the subsidy were, however, communicated with the municipalities after most of them had already implemented their plans and already made the costs. The municipalities expected a larger percentage to be funded by the province. The exact allocation key was unknown at the time, but eventually only receiving 1 euro per tree caused a lot of discontent within the municipalities and caused problems in their municipal budgets (interviews 4,8,24).

"I find it difficult that during a project things often change within terms and conditions. You have applied for a subsidy with a rough idea or an initial assumption. You applied for this subsidy and during the course of the project all kinds of things change and then it no longer matches the initial application 100%. You don't really know in advance how the subsidy supplier is going to react to that. Are they going to say: you have chosen a different variant or species so we will withdraw the subsidy? How the province organized the subsidy with new conditions and requirements all the time and the wrong pre-consultations was very messy and very annoying all around." – Municipality of Beesel (24:246-250)

Goal should be aimed at heat stress diminishing measures

Most municipalities do, however, add that a subsidy for trees is necessary as a shortage of budget for green measures is experienced by many municipalities. Municipalities emphasize the need to apply terms and conditions to plant more adult trees that diminish heat stress in the urban area (interviews 4,8,10,24).

DHZ-Arrangement

The DHZ-arrangement is an arrangement that originates from the Delta Plan High Sand grounds which is targeted at preventing drought. The funds from this Delta Plan gets divided amongst the provinces, which in turn divide the funds to the water authority and the municipalities. The goal of this subsidy is to retain as much water in the soil as possible (interview 9).

Dividing the subsidy

This subsidy got divided via a tender where all municipalities could submit projects. Seven municipalities have applied for the DHZ-arrangement. The projects they submitted were mainly about climate adapting a neighborhood of the municipality; bringing back a more robust environment, a greener environment or disconnection from the sewage (interview 9). Some municipalities have done this more extensively than others; Simpelveld for example is climate proofing an entire village while other municipalities improve one bottleneck or neighborhood (interview 9).

Water authority

Next to the municipal projects the water authority is implementing 80 projects which are partially funded by the DHZ-arrangement. The vast majority of the budget went to brook and stream restoration projects (interview 9).

Bureaucracy of the DHZ-arrangement

The bureaucracy of the DHZ-arrangement got experienced as the main obstacle within the DHZ. Applying for the DHZ-funding has to be done by a municipality. Previously, the DHZ-arrangement could be used in Waterpanel Noord as funding for the disconnection of the sewage subsidy (interview 23). The region of Waterpanel Noord, which consists of 15 different municipalities, have tried to bundle and lower their administration by having one municipality apply for all 15 municipalities. This proved to be an administrative burden because of the different types of administration and manners of registering the granted subsidy by all the different municipalities. The municipalities would prefer the province to make the DHZ-arrangement less administratively burdening and accept or guide the different manners of registering the subsidy. Eventually the administrative accountability of the allocated amount of subsidy to the disconnected square metres got experienced as quite extensive and time consuming (interviews 13,15). Therefore a manner to reduce the administration afterwards would be an improvement municipalities would prefer in next tenders (interviews 13,18,24,25).



Figure 11: Partly DHZ funded restructuring in Bocholtz, VZP advies (2021)

Disconnection of the sewage subsidy

A financial incentive was created to incentivize private property owners to invest in disconnecting their parcel from the sewage. The goal of the subsidy is to create awareness amongst inhabitants and to disconnect as many square meters of private property from the regular sewage as possible (interview 18). This subsidy has been implemented in the last two years and recently got extended for another two years (interview 18).



Figure 12: Disconnection from the sewage in Weert, Heerlijk Weert (n.d.)

Process

There is a certain process that municipalities follow before granting the subsidy. First of all, only inhabitants and small businesses can apply for disconnecting their property from the sewage. Before they can apply, a civil servant, or consultancy, will visit the property to check if the property is eligible for the subsidy and to form an advice about how to disconnect from the sewage. Afterwards, the private property owners can apply for the subsidy, which needs to be processed in the municipality's records. Finally, the municipality or the consultancy firm has to check if the measures are taken (interview 14).

Outsourced process costs are too high

The sewage and water civil servant at the municipalities have to implement this arrangement within their daily tasks. Because of the already existing shortage of hours this subsidy sometimes got completely or partially outsourced. In the terms and conditions a percentage of the subsidy got assigned to the process costs which cannot be increased (interview 10).

The problem with the outsourcing is that the costs of the process are higher than the percentage that was calculated for these costs, resulting in municipalities not being able to use all the funds for climate adaptive measures (interviews 10,16). Therefore, in the end, there is still budget left for climate adaptive measures because there is no more budget for the higher process costs (interview 10). In the region of Parkstad, where all of the process got outsourced, this proved to be a major problem. In the next two year period the region will not outsource this arrangement again and will merge their processes by putting the subsidy in one central place, which is the Woonwijzerwinkel (interview 16).

“Parkstad tried to implement the arrangement themselves at first but actually it was too much work for the municipalities. They then decided to outsource it. A consultancy accepted the tender and the process costs were solely costs for the municipalities. Sometimes only consultations were held for the same costs but nobody applied for the subsidy. On average one request, which contains maybe 50 m² of disconnecting from the sewage, costs 350 euros of process costs and 500 euros for the actual climate adaptive measures. That is, of course, absolutely ridiculous.” – Parkstad Region (16:56)

Lack of flexibility in amount per square meter leads to fewer applications

Next to the high process costs the lack of flexibility within the amount that is allowed to be subsidized got experienced as a problem in the south of Limburg. Because of the physical features of the loess and the height differences, the costs of the measures to disconnect from the sewage are higher than in the north of Limburg, resulting in the subsidy being less popular in the south of

Limburg (interview 18). Compared to the north of Limburg the south of Limburg often still had a big amount left in their allocated budgets. The southern municipalities want to increase the amount per square meter, which they hope will increase the amount of applicants (interview 18). It has recently been decided, both with the municipalities and the water authority, to increase the amount of subsidy per square meter in the south of Limburg and let the municipalities decide how high the amount of subsidy should be (interview 18).

Maximum of square meters hurdles the inclusion of social housing corporations and businesses

Another obstacle experienced by municipalities is the set maximum of square meters. The water authority, who created the terms and conditions, applied a term that no more than 300 square meters could be disconnected from the sewage without extra administration. The reason for implementing a maximum is because the subsidy was perceived as a subsidy for inhabitants and to increase their climate adaptive awareness (interview 18). This resulted in a difficulty for municipalities to also include bigger private property owners such as social housing corporations or businesses that possess a lot more of square meters to get disconnected from the sewage. In the future the water authority will loosen this term and will no longer maintain a maximum of square meters (interview 18).

Subsidy cannot be used for green measures

A big remaining obstacle is the inability to use the subsidy for other climate adaptive measures next to disconnecting from the sewage. An example is installing green roofs. Because the water can not completely be absorbed by the green roof this measure does not qualify for the subsidy (interview 18). The municipalities would prefer to expand the arrangement for green measures. This would also have the benefit of citizens not having to double apply for a subsidy and the municipalities not having to organize a separate process for green related measures (interviews 9,19,23). The water authority chose not to include green measures in this subsidy because this results in difficulty to keep track of the amount of disconnected square meters. Therefore they do not, in the near future, see a possibility to combine these two goals. This has resulted in green measures having to become a separate subsidy system which, at the moment, is only implemented in two municipalities (interview 18,23).

POP-3 and other agricultural arrangements

The agricultural sector receives separate subsidies. Climate adaptation is part of the POP-3 arrangement which stands for Rural Development Program. Climate adaptive activities next to increasing the production can receive subsidy within this program (interview 9). When farmers, for example, place a rainwater buffer on their land or place water retaining walls they receive a subsidy from the province (interview 9).

Another subsidy provided by the water authority is meant for changing the agricultural production to a more climate adaptive way of farming. The subsidy contains 12 measures that farmers can implement to retain extra water on agricultural plots. They ensure that the water can infiltrate into the soil better and slow down the runoff from slopes as much as possible. Examples are placing straw bales on the land to retain water or sowing maize in a diamond pattern (Waterschap Limburg, 2021). The POP-3 arrangement proved to be a popular arrangement which was quickly closed. The other arrangement from the water authority got released during the internship period and therefore no conclusions can be made yet (Personal communication, 2021).

Subsidies are short term solutions

The downside of subsidies is that they are often short term solutions. An example is the subsidy for the 'Ik groen het project' in the Parkstad region. This is a project to improve biodiversity in private properties. Inhabitants can sign up their street to destone their front yards. After the inhabitants purchase their own biodiversity kit a 'destoning festival' gets arranged by the organization to destone the front yards together (Observation 3). This became so popular there was not enough budget for all the streets that signed up. This project was financed by a subsidy from IBA Parkstad who did not want to extend this subsidy, resulting in there not being any funds to tend to the destoned gardens and not being able to extend the project to other neighborhoods. Municipalities therefore ask, whether from the province or the national government, for a structural financial impulse within green measures to prolong these kind of projects such as greening private property (Observation 3).

Being able to combine subsidies

Flexibility in the terms and conditions is another improvement which could help to maximize the use of the budget for climate adaptive measures. The most suggested change is the opportunity to link the DHZ-arrangement with the DPRA-arrangement, as some projects would be eligible for both (Observation 4, personal communication, 2022). Delta plans, however, are not allowed to be used simultaneously because of a set national term. Municipalities and the province would therefore prefer the national government to set up more flexible arrangements that can be combined (interviews 6,9,13,23,25). Secondly, within the other subsidies the combination of goals should be possible, such as combining green measures with disconnecting from the sewage, in order to create budget synergies and more encompassing subsidies for climate adaptation instead of working within separate goals (interviews 6,13,23,25).

"Often the tension is really within the budgets. You should really start doing integral projects where you create one general central budget. From this perspective you start looking at what are the best measures and start drawing the money from that." - Southern Regions (23:332)

Contribution arrangement lowers administration

Another improvement would be to change the subsidy system by increasing the cooperation between the province and the municipalities. The municipalities would prefer to reduce the administration of future provincial subsidies (interviews 6,13,14,18,24,25). The province of Noord-Brabant has discovered a way to lower the administration and created a contribution arrangement. This arrangement is focused on water projects with a bigger scope than the municipality or even a region. With the contribution arrangement the province becomes co-owner of the project and gets more involved from the beginning of the project, resulting in needing less administration afterwards (interview 1). The Limburgish municipalities would prefer this system as well because it relieves some of the workload, both before and after the projects.

Taxing

Another important instrument municipalities are researching is the use of taxing to incentivize private property owners to either reduce the amount of paved square meters or disconnect from the sewage. With the exception of the damage caused by shock events, climate adaptation currently does not have a financial argument for private property owners to adapt. A taxing system could introduce this incentive (interviews, 9,16). Reducing paved square meters via a taxing system is less popular within municipalities and regions. The municipalities biggest concern is the rising costs for

inhabitants, checking the amount of square meters and the extra work it creates to implement a new taxing system (interviews 4,6,23,25).

Taxing is generally not a very popular political decision, therefore most municipalities prefer not to implement a tax. When municipalities mention they do want a future tax the preference is to tax private property owners to disconnect from the sewage. This has multiple benefits such as reducing drought in the north of Limburg and reducing water nuisance in the south. The main thought is to reduce the sewage tax when private property owners disconnect from the sewage and increase the sewage tax for private property owners who do not disconnect. How much the sewage tax should increase and if there is still enough budget for other water projects if this system is applied, are the main questions municipalities are still researching (interviews 8,10,16).

Water authority tax

The water authority taxes every household for the use of water and a high quality water system. The water authority can choose to increase the water tax to implement more measures or because of inflation. The water authority chose to increase the water tax for the upcoming year by around 10 percent because of the bigger challenges such as climate change and the renewal of the water system (interview 17). There has been a discussion about the increase of the tax. The provincial states have submitted a motion to no further increase the water tax because of the already increasing other costs for households. The water authority, however, presses its concerns because of the possible higher workload when a norm of 1:100 in the south of Limburg has to be achieved and the new tasks of the proposition have to be implemented. The proposition is a document / request made after the flood which enhances on new water measures and working towards a climate adaptive water system. According to the water authority another increase of the water tax might be unavoidable in the future if the workload of the water authority increases (interview 17).

5.3.4 Legal instruments

Legal instruments refer to the legitimate power of governments to permit, prohibit, or command action by target populations. Actors are assumed to be motivated by a commitment to obey government-issued directives (Henstra, 2016). The current legal instruments consist of the Keur of the water authority, the provincial ordinance and the municipal ordinance. This paragraph will progress from the previously made argument of the need to rule and regulate climate adaptation and will elaborate on the various legal instruments. The current legal instruments, how these instruments could be improved and the various ideas to legally embed climate adaptation will be the focus of this paragraph.

Water authority regulation: water test

The Keur consists of the rules, requirements and prohibitions set by the water authority. One of these requirements is the water test. The water test should ensure a good coordination of water and spatial planning in zoning plans. The water authority implements a water test within all spatial plans which are bigger than 2,000 square meters and gives advice about water related subjects (interview 17). Because of the relatively smaller task within the province of Limburg to build more houses or create large scale spatial plans, the amount of times the water authority had to be involved in spatial plans is relatively limited. The water authority expressed when it was necessary to apply a water test, the municipalities mostly informed them in a beginning planning stage (interview 17).

The water test, however, is mostly an advisory policy instrument. Motivating why the water authorities requirements are not achievable can be sufficient to derive from the water test. Occasionally, project developers try to evade the advice because of the costs of the water measures. In the Netherlands, the policy is to 'retain, store, drain' water. The rainwater is first retained as locally as possible, then stored in surface water or other storage facilities and only when this is not possible the rainwater gets discharged (interview 17). This principle is applied by an advice and requirements provided by the water authority within new spatial plans but is not enforceable. Therefore the advice is avoidable and a more regulatory instrument seems necessary to enforce this principle which reduces drought and water nuisance (interview 18).

Disconnection of the sewage

Newly built area is often disconnected from the sewage. What is more difficult is to enforce disconnection within the existing urban area and restructurings. Project developers rather avoid the disconnection of the sewage as it creates higher costs for building and requires room to store the water. Secondly, it is legally impossible to enforce disconnection of the sewage within the existing built area as inhabitants have a right to connect to the sewage (interviews 9,18). Therefore disconnection of the sewage is still not ensured to be implemented within restructurings, sometimes even in newly built areas, despite the efforts of municipalities to include disconnection of the sewage within their policy rules. One step further would be to include disconnection of the sewage in provincial or municipal regulation (ordinances). Therefore no exceptions can be made (interview 18).

Disconnection of the sewage includes two elements: the actual requirement of not allowing a private property owner to connect rainwater to the normal sewage, which is only possible in newly built areas, and the norm for water retention within the (project) area. Within water retention two norms can be identified: the water authority norm and the municipal norm.

Norm for millimeters of storage

One of the main rules regarding climate adaptation in the Keur is the requirement to store 100 millimeters of water per plot in the north of Limburg, and 80 millimeters of water per plot in the south of Limburg. This requirement is only valid for new spatial plans that are larger than 2,000 square meters (interview 17). Most new spatial plans and developments in the province of Limburg are below 2,000 square meters and therefore most municipalities that were interviewed did not have to comply with this new requirement yet (interview 17).

Need for municipal rainwater ordinance

Most municipalities have their own norm for millimeters of storage which is, most of the time, lower than 100 or 80 millimeters. This norm is applied in the municipal sewage plans and is valid for plans smaller than 2,000 square meters. However, municipal sewage plans contain policy rules which can be diverted from when sufficiently motivated (interview 23). Therefore the smaller scale plans sometimes do not include water retention because of motivated arguments by project developers of why the norm is not feasible in the project area. Therefore a rainwater ordinance is necessary to enforce disconnection from the sewage in new spatial plans (Interview 23, personal communication, 2021).

Water authority flood norm: feasible? abolish? or increase?

The water authority is, in principle, an executing governmental body. The province decides on the flood norms that the water authority has to maintain. The water authority implements measures to work towards these flood norms. Because of the recent flood event there is a discussion about increasing the flood norm to once every 100 years in the south of Limburg. The current flood norm is once every 25 years in the southern parts of Limburg. Increasing the flood norm means the water authority has to perform more measures to comply with a higher norm (interviews 16,19,23). The water authority does not think a higher norm will be feasible because of the high costs of measures which will be necessary to maintain this norm. Another discourse present within the water authority is to completely let go of the flood norm because of climate change and the increasing occurrence of extreme weather events (interview 17).

On the contrary, the municipalities believe that the flood norm should be increased and express it is unknown how high the costs of the measures for a higher norm are going to be. They first want to conduct a research about the possibility of increasing the flood norm and decide afterwards if this is achievable and affordable (interviews 6,16,23). The municipalities fear the insurance companies will not cover future flood damage when a higher flood norm will not be maintained. Officially, only vertical water gets insured, meaning horizontal water coming from brooks and streams, which have flooded plenty of buildings during the flooding of 2021, were not officially covered under the insurance terms and conditions (interviews 16,23). The province has agreed to conduct a research for increasing the norm, but also has recently decided to maintain the old flood norm (once every 25 years in the south of Limburg) for the near future (Personal communication, 2022).

Climate adaptation is often not included in the performance agreements

At the moment municipalities are at the beginning stage of including climate adaptation in the performance agreements with the social housing corporations. Every year these agreements are made between the municipality and the social housing corporations. Housing corporations make decisions, for example, about the social rental housing they are going to build the next year or about

the maintenance of houses. They do not take these decisions by themselves and have to consult with municipalities and tenants (interview 14).

Municipalities can include climate adaptive building within the new performance agreements. The performance agreements, however, get consulted with other civil servants than water and green. Some sewage and water civil servants were not aware if the performance agreements included climate adaptation (interviews 13,24). The survey showed only 30 percent of the municipalities have included climate adaptation in their performance agreements. Municipalities mention they are still researching how to include climate adaptation and still have to discuss the topic with the social housing corporations. Social housing corporations possess, most of the time, 1/3 of the total housing stock and therefore it is important for municipalities to try to include these stakeholders. Most municipalities express they want to include climate adaptation in the performance agreements in the future (interviews 13,14,16,24,25).

Disconnection from the sewage table

A smaller subject within climate adaptation is the disconnection from the sewage table. This is a water related instrument created by the water authority and the province to supply the municipalities with a table of how to include disconnecting from the sewage within building plans (Personal communication, 2021).

The province and water authority have found that disconnecting from the sewage is not always included within building plans in the manner they would prefer it (interview 18). This refers to the retain, store, drain principle. Often project developers do not incorporate this concept. Therefore the water authority and the province want to make the concept mandatory by including the disconnecting from the sewage table in either provincial or municipal regulation (Personal communication, 2021). Municipalities agree with the difficulty of always including disconnecting from the sewage via this concept, but would prefer to include other climate adaptive subjects within this table as well, where they mostly refer to including green measures (Observation 6).

Improve the water related instruments and include green and heat stress within these instruments

Within all of these existing legal instruments the absence of heat stress and green related rules are a reoccurring obstacle. While the water and disconnection rules can be improved there are no rules or standards for green and heat stress. An example is introducing a mandatory green percentage in spatial plans or using different materials to reduce heat stress (interview 25). When improving the water related rules and regulation green and heat stress related rules have to be included as well. Otherwise these two topics have a high chance of being disregarded again (Observation 6).

Missing instruments

The second part of this paragraph will contain the various ideas to rule and regulate climate adaptation. Municipalities, the province and the water authority still have to make a decision upon applying any of these future instruments.

Motivational climate adaptive paragraph

One of the ideas within the province is to create a climate adaptation motivational paragraph within all of the new spatial plans. Therefore all projects and initiatives have to motivate how they plan to prevent drought, heat stress, flooding and water nuisance (Personal communication, 2022). Most municipalities expressed the need for this paragraph as climate adaptation is often overlooked in spatial plans by other interests or project developers (interview 16,23,25). The remaining question,

however, is if this instrument is enforcing enough. Experiences with past instruments have shown project developers will try to evade climate adaptive measures by using underpinnings why climate adaptation is not possible (Personal communication, 2022). A stricter policy instrument is therefore preferable when deciding on regulating climate adaptation.

Water as a guiding principle

Another dominant discourse next to climate adaptation is to include water as a guiding principle. This has been a national interest which could be included in the provincial regulation. Water as a guiding principle refers to incorporating water into all spatial plans and not building on places that have a high chance of flooding or water nuisance. This can be implemented by a provincial instruction rule with maps of areas where there can or cannot be built (interview 26).

Municipalities generally do not believe this extra principle is necessary. The municipalities mention they already incorporate water as much as possible and also, based on good intentions, do not want to build at places with a high flood risk (interviews 4,6,10,13). Municipalities emphasize the fact that there are also other ways of building instead of not building at all. An example is to build new neighborhoods on mounds or built with other materials. They would therefore prefer not to designate areas where you are not allowed to build but regulate a climate adaptive style of building (interviews 6,15,19,23). Municipalities refer to changing the Building Code at the national level where certain norms and standards regarding climate adaptation can be added (interview 25).

“The building code is very important where you can regulate a lot in. For example, you can include a rule where it isn’t allowed to install electrical outlets at a floor level anymore.” – Municipality of Venlo (25:195-199)

Climate adaptive building covenant

The province of Utrecht and Zuid-Holland have implemented climate adaptive building covenants to enforce certain norms and standards for climate adaptive building. An example is a percentage of shade or a percentage of how much water should be retained in the soil. Because of the majority of different ideas to rule and regulate climate adaptation a Limburgish version of the building covenant could be an option to merge all these different ideas. Therefore no separate rules about disconnecting from the sewage, a green percentage or building materials would be necessary. At the moment this option is explored marginally and the compartmentalization plays a role within the rules and regulation as well by trying to rule and regulate every goal separately.

Irrigation covenant

One of the main causes of drought is the use of groundwater. The main users of groundwater are farmers. When the farmland is dry the production decreases and therefore farmers irrigate their crops using groundwater (interview 17). Because of groundwater usage the groundwater level decreases which has negative effects on the surrounding nature. Second, when the water level decreases to critical amounts the surrounding buildings in the area could slump. Therefore prohibitions to irrigate the land get deployed by the province (Personal communication, 2021).

The gap or fault within this system is that small scale water users, such as smaller farming businesses, do not have to comply with this prohibition. They merely get advised to lower their water use (interview 17). Enforcing a prohibition for small scale users is almost impossible because of the multitude of these water users. The province is now researching if it can fill this gap by creating an irrigation covenant to include the small scale farming companies. Within this covenant agreements

can be made about the use of water. This is still an option that the province is researching and could be applied in the future to reduce drought (Personal communication, 2021).

Land consolidation service

The water authority missed one instrument to implement climate adaptation and other water related topics better. There used to be a land consolidation service (DLG: Dienst Landelijk Gebied) which used to trade plots of land to organize the different functions in one area more efficiently. This service got disbanded about 10 years ago and was a part of the ministry of agriculture, nature management and food supply (interview 17). Parcels of land were exchanged from one farmer to another to organize the farmland in larger blocks which prevented scattering. It later became an implementing organization, especially around nature reserves, to ensure that when more nature had to be created, the land was purchased and the farmers were compensated for the land (interview 17). The water authority expresses the need to divide the plots more efficiently again within a similar organization. The province has more spatial instruments and has a bigger role in spatial planning which is important to divide functions at the right places. The water authority sees a role for the province to start organizing this land plot exchange to ensure water and nature get spatially embedded and farming can be situated at less fragile places. For example, farming lands on steep slopes could be traded for lower grounds. This prevents the uphill runoff of water by exchanging the farming function for a nature function (interview 17).

5.4 Current policy instrument mix

To maintain a general overview the included table below contains the current policy mix regarding climate adaptive policy instruments in the province of Limburg. In order to answer the final sub research question the recommendations and missing policy instruments for each category are included.

Green: well-functioning policy instruments

Orange: policy instrument could be improved

Red: malfunctioning policy instrument

Information and communication instruments

Current policy instruments	Recommendations	Missing instruments	Recommendations
- Water related research	These researches proved to be a necessary foundation for the future climate adaptive measures and serve mostly as background information.	- Heat stress related research	Research is needed within heat stress and green related measures in order to create a complete climate adaptive overview of measures which can be used for follow-up instruments.
- Stress tests	Experience based information is preferred. Stress tests are momentarily mostly used as background / supportive material.	- Reducing pavement and encouraging green campaigns / actions	Missing communication campaigns in green and reducing pavement. More priority should be put on these, generally easy to implement, actions.
- Risk dialogues	The risk dialogues are more focused on creating awareness than actually creating a strategy for an area specific climate problem. Multiple risk dialogues are often necessary in order to create or solve a problem. Both internal as external risk	- Measure specific research	Measures such as taxing or the flood norm still need research in order to make a political decision.

	<p>dialogues are experienced as too non-committal.</p> <p>An actual commitment to the process in an agreement/covenant is necessary in order to commit the stakeholders to the process</p>	<ul style="list-style-type: none"> - Core numbers of measures system 	<p>Structure is needed within the climate adaptive measures to make the most optimal decisions in spatial plans as it is currently mostly based on intuition. A step by step guide is necessary within municipalities containing the measures, costs, benefits and effects to make more well-balanced decisions.</p>
<ul style="list-style-type: none"> - WaterinLimburg.nl 	<p>To spread knowledge this website proved to be a useful source of information about other municipal projects or strategies. The tool is, however, not used very often, because of a lack of human capacity to keep up and being mostly focused on water.</p>	<ul style="list-style-type: none"> - Improving communication within governmental levels 	<p>Improvement in communication between governments is necessary. Either by reducing the meeting structure, improving the human capacity or more regular updates.</p>
<ul style="list-style-type: none"> - Waterklaar 	<p>Spreading the climate adaptive awareness amongst inhabitants could be improved by promoting it more in municipal communication. Other options gaining more public attention could be explored as well.</p>		

Table 10: Information and communication instruments

Organizational instruments

Current policy instruments	Recommendations	Missing instruments	Recommendations
<ul style="list-style-type: none"> - Linking climate adaptation to other projects 	<p>Overall climate adaptation gets included in restructurings. A disadvantage is this process is generally slow because of the lock-in situation of water measures. In order to achieve a climate adaptive environment by 2050 extra measures or budgets next to this strategy are necessary.</p>	<ul style="list-style-type: none"> - Assign a policy focused civil servant on climate adaptation 	<p>Climate adaptation is in the beginning stages of the policy process. Therefore it is necessary to include a policy related civil servant, as water civil servants are more maintenance and project oriented.</p>
		<ul style="list-style-type: none"> - Research for linking opportunities 	<p>The linking opportunities in other domains are often unknown and therefore these linking opportunities are also not getting implemented in practice. A research is necessary to discover these opportunities.</p>
<ul style="list-style-type: none"> - Organized within the water departments / domains 	<p>Climate adaptation is an extra task for the water civil servant, encouraging the already existing water discourse and resulting in climate adaptation landing in an overstructured and overburdened policy domain. Bending these organizational barriers includes multiple steps presented in the missing instruments.</p>	<ul style="list-style-type: none"> - Administrative order for including climate adaptation internally 	<p>Including climate adaptation in everyday tasks of other civil servants requires an administrative order or another enforcing internal instrument. Other instruments such as the environmental visions are found to be too non-committal.</p>
		<ul style="list-style-type: none"> - Multi-disciplinary team 	<p>A multi-disciplinary team could create a more encompassing climate adaptive strategy to work on climate adaptation next to water and green and include the linking opportunities discovered in research.</p>
		<ul style="list-style-type: none"> - Decentralize the budgets within governments 	<p>In order to implement the linking opportunities and the multi-disciplinary team to function optimally the budgets that could be used for climate adaptation should be decentralized.</p>

Table 11: Organizational instruments

Economical instruments

Current policy instruments	Recommendations	Missing instruments	Recommendations
- DPRA Impulse arrangement	To reduce the water focus the DPRA Impulse arrangement should incorporate green and heat stress related measures and not include them as a linking opportunity.	- Financial incentives for green measures (both in public as in private areas)	A big shortage of funds is experienced for green related budgets. Including green related measures in existing water funds will improve the inclusion of green. When this is not possible separate green subsidies are necessary.
- DHZ Drought subsidy	The DHZ drought subsidy should improve the administrative obstacles by more and earlier involvement from the province in the projects and trying to reduce administration afterwards.	- Contribution arrangement	In order to reduce the administration and relieve the municipal shortage in human capacity the subsidy system could be redeveloped by contribution arrangements.
- One million tree plan	Heat stress diminishing goals should be applied to include more adult trees and therefore reduce heat stress. Second the cooperation between the municipalities and the province could be improved by timely and clear information and communication.	- Sewage tax differentiation for disconnecting of the sewage	A sewage tax system could be preferred for sanctioning owners of parcels of land to disconnect from the sewage. This creates a financial incentive for these property owners. It is debatable if the municipalities want to include a sewage tax.
- Disconnecting from the sewage subsidy	The subsidy should broaden its goals to green related measures in order to improve the inclusion of green related measures in private property.		
- Investing in programs (Room for the brook, water in balance and the area guided approach)	Investment in programs are mostly big rural area bottlenecks which need the incorporation of provincial and water authority's funds and human capacity.		

<ul style="list-style-type: none"> - Pop-3 - Agricultural arrangements 	<p>Overall successful subsidies for farmers (from a provincial perspective).</p>		
<ul style="list-style-type: none"> - Water authority tax 	<p>The tax is connected to the implementing capacity of the water authority. Climate change causes the need for more measures and therefore to more expenses. A future increase in the sewage tax seems inevitable</p>		

Table 12: Economic Instruments

Legal instruments

Current policy instruments	Recommendations	Missing instruments	Recommendations
- Environmental visions	The environmental visions are too non-committal to serve as a guarantee that climate adaptation gets implemented within the whole province or municipality. An extra instrument such as the administrative agreement is necessary to enforce the subject in bigger organizations.	- National building code climate adaptation	Municipalities prefer to include climate adaptive building in rules and regulations within the national building code. Other instruments such as a motivational paragraph might be too non-committal as project developers already currently try to avoid climate adaptive building by evasive arguments.
		- Municipal rainwater ordinance	A norm for millimeters of water storage is necessary to reduce both drought and water nuisance. Currently spatial projects smaller than 2,000 square meters are still able to connect to the sewage as the municipal norm is only embedded in policy. Therefore a rainwater ordinance is necessary to enforce this rule.
- Water test	Serves mostly as an advice from the water authority which later can get weakened by project developers with evasive arguments.	- Climate adaptive building covenant	A climate adaptive building covenant can help structure the multitude of ideas to regulate climate adaptation. When choosing for a covenant all climate adaptive measures should be included (water/green/heat stress).
- Norm millimeters of water storage water authority	Implemented norm containing millimeters of water storage by the water authority. Only valid for projects which are bigger than 2,000 square meters. New big scale projects are therefore forced to disconnect from the sewage.	- Exchange of plots	Farming at steep slopes is increasing the water nuisance downhill. In order to structure the location of these farms the water authority mentioned missing a land consolidation service.

<ul style="list-style-type: none"> - Water authority flood norm 	<p>A debatable policy instrument which protects the north of Limburg 1:100 years of flooding and the south 1:25 years. Therefore the south of Limburg is less protected against future flooding. The norm could be increased, maintained or abolished. Research is necessary if it is possible to increase the norm or if maintaining a norm is unfeasible.</p>	<ul style="list-style-type: none"> - Irrigation covenant 	<p>In order to reduce drought an irrigation covenant is perceived necessary by the water authority and province to enforce agreements made about the water usage.</p>
<ul style="list-style-type: none"> - Disconnection of the sewage table 	<p>The disconnection of the sewage table is a possible future legal instrument providing steps to embed the retain-store-discharge principle. A more inclusive solution would be to include green measures in this table creating the structure which is necessary to base new spatial plans upon.</p>	<ul style="list-style-type: none"> - Performance agreements social housing corporations 	<p>Performance agreements are currently mostly not including climate adaptation. The social housing corporations own 1/3 of the property in Limburg and therefore performance agreements should be made about climate adaptation.</p>

Table 13: Legal instruments

6. Conclusion

This thesis has aimed to analyze the highly fragmented and complex policy arrangement within climate adaptation, its policy instrument mix and to contribute to several scientific knowledge gaps. Firstly, underlying patterns in the policy arrangement which influence the policy mix were conceptualized in several factors. There is a current research gap to disentangle how different factors drive the design of efficient or non-efficient policy mixes (Capano & Howlett, 2020). Several underlying patterns and factors that influence the current policy instrument mix were found. These underlying patterns and factors will be elaborated on in the second sub-research question.

Secondly, the policy instrument mix has been analyzed as these instruments can create interactive effects among them which can be complementary or supplementary. A key principle of current policy design thinking is to maximize complementary effects and minimize conflicting ones (Capano & Howlett, 2020). Therefore the second part of the thesis focused on the policy instrument mix itself and the improvements that can be made within this mix. This has resulted in several improvements, such as a need for flexibility within subsidies, the need to decompartmentalize budgets, to reduce the administration afterwards, and the overall need to structure and regulate climate adaptation.

Thirdly, literature argues selecting policy instruments depends on the resources and capacities at the disposal of governments. There is an empirical knowledge lacuna on evidence whether and how the characteristics of the actual stock of resources and capabilities at governments' disposal influences the choice of policy instruments and eventually their implementation (Capano & Howlett, 2020). The results have found that governments are restricted by their resources, such as high investment costs or the limited human capacity, leading to governments not being able to implement all the instruments they deem necessary in the most efficient manner or are forced to phase out the investments. Therefore, according to the results, resources do not directly have an influence on the choice of policy instruments, but on the implementation of these policy instruments, which sometimes, because of restricted resources, cannot be performed efficiently or more rapidly.

The final research gap is the multi-level governance arrangement. Different levels of government are likely to have some common, but also some different, goals and instrument preferences and reconciling them involves the intragovernmental or intergovernmental bargaining and decision-making which may or may not lead to efficient or effective instrument choices and policy designs (Capano & Howlett, 2020). The results showed higher level governments have a substantial influence on the lower level governments, as they mostly provide subsidies and funds covering a big part of the expenses. Therefore higher level governments mostly decide which climate adaptive measures can get implemented by lower level governments. The water bottlenecks in rural areas, for example, have exceptionally high investment costs and can therefore not be financed by a municipality themselves. An additional vertical influence is the requirement of needing approval from the water authority and the province for the regional projects. Consequently, the municipality is therefore financially dependent on higher level governments. This does not per se lead to an inefficient policy instrument mix, but to a top down steered water perspective excluding other domains' measures for funding.

Furthermore, the conclusion answers the main research question:

How are climate adaptive policy instruments being used by Limburgish governments and which constraints does this policy mix have?

This main research question can be divided in the three sub-research questions which entail on the current policy arrangement, the policy instrument mix and the alignment between the policy arrangement and the instrument mix.

What is the current policy arrangement within climate adaptation in the province of Limburg?

The current policy arrangement concerning climate adaptation can be typified by fragmentation, limited human capacity, water dominance within the discourse and the largely unregulated and unstructured policy arrangement.

Water related discourse

Firstly, climate adaptation gets operationalized differently by the three governmental levels. On a national and provincial level climate adaptation refers to reducing drought, water nuisance and prevention of flooding. This can be identified as the water related discourse and the start of climate adaptation being operationalized economically, organizationally, and legally within the scope of these three subjects. On the contrary, regions and municipalities define climate adaptation as a broader subject which affects various domains and interests, such as spatial planning, housing, infrastructure and greenery. The municipalities regularly experience the obstacles of the national definition because of the limited financial ability to include other climate adaptive measures next to the three defined themes.

Fragmentation of the climate adaptive meeting structure

Another trait of climate adaptation is the fragmentation. Each individual topic or goal within climate adaptation has its own meeting structure, actor coalitions and resources. This has caused an overstructured and overburdened policy arrangement where the different goals overlap, the overview is lost by the actors, and the increased meeting workload results in the water civil servants not being able to keep up and are therefore not up to date.

Lack of human capacity

Additionally, within the policy arrangement there exists an overall limited human capacity to work on climate adaptation. Because of the newness of climate adaptation, it still needs to claim its human capacity in the province, the water authority and the municipalities. Climate adaptation is an add-on to the water civil servants tasks and sometimes does not get included separately within the civil servants' hours. At all governmental levels there is a shortage of personnel to implement the already defined projects and the existing policy instruments. Therefore adding climate adaptive projects or instruments is difficult because of the shortage of human capacity to implement them.

The province must take a bigger role

Within the policy arrangement the role of the province of Limburg in climate adaptation is relatively small in the urban area. According to the process coordinators of the different work regions and the municipalities the province must take a bigger role in the regional cooperation's. The water authority, who currently has the more directive role, has a water related scope. Therefore the water dominant discourse gets enhanced and the measures mostly stay water related. This results in a whole array of green or spatial planning measures staying on the background. The regions would prefer to go beyond the water related measures and therefore need the cooperation and a more directive role of the province.

Water related measures are a lock-in situation

Next to the shortage in human capacity the financial capacity is a hindering factor in the current policy arrangement. Changing an infrastructure such as the sewage system and solving bottlenecks cannot be implemented on a large scale because of the high costs of these measures. Therefore the existing sewage and water structure is a path dependent system which has to be phased out in order to create a completely climate adaptive public space. The main issue with this approach is that climate adaptation is often seen as a linking opportunity. A big part of the municipal strategy is to include climate adaptation within these restructurings of the sewage system. Therefore the whole climate adaptive issue will be phased out, causing a high chance of not achieving the goal of becoming climate adaptive by 2050.

How does the policy arrangement align to the policy instruments?

The second research question focuses on the alignment between the policy arrangement and the policy instruments. The policy arrangement can provide constraints for the policy instrument mix and explains the emergence of the current mix. The following factors from the policy arrangement were found to be influencing the policy instrument mix:

- *Definition of climate adaptation on a national level*
- *Fragmentation of the actors and resources*
- *Insufficient role of a higher level government (province of Limburg)*
- *Shortage in human capacity*
- *High costs for water related measures*
- *Path dependent sewage system*
- *Uncomplete overview of the measures: effects, costs and benefits*
- *Unregulated policy domain*
- *Physical features of the environment*

Alignment to the information and communication instruments

A recurrent pattern within the information and communication instruments is the predominant water focus. This water focus can be explained by the national definition which results in climate adaptation being organized in the water department. This domain and its civil servants naturally have a more water related focus and therefore more water related knowledge and communication instruments exist.

Alignment to the organizational instruments

In relation to the previous argument, the organizational instruments got influenced by the national definition most predominantly. The definition caused climate adaptation being organized in the water department. When implementing a theme such as climate adaptation the broadness requires flexibility to implement measures beyond the water domain. Therefore organizational instruments are needed to expand this water related focus.

Alignment to the economical instruments

Within the economical instruments the national definition, the fragmentation of the actors and resources and the limited human capacity were the main factors influencing the economic instruments.

Higher level governments mostly grant subsidies and funds for lower level governments. The province and the Delta Plan defines climate adaptation as drought, flooding and water nuisance.

Heat stress, and therefore many green measures, are perceived as a linking opportunity. This has caused funds being predominantly aimed at the three main themes.

Secondly, the fragmentation of the policy arrangement relates to higher level governments creating funds and subsidies for specific goals. This compartmentalization leads to lower level governments not being able to combine these funds or subsidies because of the complex administration process afterwards and because of terms and conditions not allowing synergies.

Finally, within the municipalities the lack of human capacity leads to municipalities not being able to implement policy instruments themselves. Therefore part of the process, or the whole process, gets outsourced. This leads to inefficient policy instrument usage as the prices of outsourcing are too high for the set percentage for the process costs. Eventually, the percentage of process costs is reached earlier than the budget for the climate adaptive measures, resulting in part of the budget that is allocated to climate adaptive measures not being used.

Alignment to the legal instruments

The policy arrangement does not contain many rules and regulation for climate adaptation. The unstructured and unregulated policy arrangement leads to project developers being able to build in a non-climate adaptive manner. The governments have found that these external stakeholders have to be steered by rules and regulation to prevent non-climate adaptive actions. Therefore research is being conducted how to prevent these non-climate adaptive activities.

Physical features

Finally, the physical features have caused different terms and regulation for the south of Limburg. Because of the physical features the costs to adapt becomes higher. Therefore many policy instruments adapt terms and conditions to these circumstances because measures are otherwise experienced as unachievable and unaffordable. This results in lower standards for the south of Limburg which eventually leads to the south of Limburg being less protected against future climate change than the north.

What climate adaptive policy instruments are being used by Limburgish governments and which climate adaptive policy instruments are missing or malfunctioning?

The current policy mix is mainly focused on water related policy instruments. This mix is mostly used for disconnection of the sewage, solving big climate adaptive bottlenecks and investing in the different programs of the three governmental levels. Within the different categories some pressing malfunctioning or missing instruments were discovered.

Information and communication instruments

Knowledge lacuna in the policy instruments

Water related measures have been extensively researched. Climate adaptation does not solely exist out of water related measures and, according to the municipalities, includes at least heat stress and green related measures, but preferably also spatial planning, infrastructure and the energy transition. The biggest current knowledge lacuna mainly exists within these themes; the linking opportunities next to water, heat stress and green. This information base has to provide the necessary information for later policy instruments, such as an administrative agreement or a future building covenant, to be able to include these measures.

Structure in climate adaptive planning

Even within the water related measures municipalities experience the need to form a decision making structure or guideline. This guideline preferably includes the green and heat stress measures. The municipalities would want to create a provincial structure, or key numbers and indicators system, in order to take the most optimal climate adaptive decisions in new spatial plans. Currently, these decisions of which climate adaptive measures will be implemented within municipalities is based on intuition.

Communication could be improved

In addition, improvements could be made in the communication between the different governmental levels. The communication between the governmental organizations about the policy instruments was malfunctioning within multiple policy instruments. Terms and conditions or new rules were communicated in the overburdened meeting structure, which water civil servants do not always attend. This leads to confusion and mistakes that could have been avoided by more clear communication and repetition of information.

Economic instruments

Terms and conditions of the subsidy make a big difference

Within the economic instruments the terms and conditions of the subsidy made the difference whether a subsidy was considered successful or not. An overall conclusion could be made that when subsidies were provided on a larger scale such as the province, the possibility of a flexible arrangement should be maintained. The local situation in each municipality is different, therefore different terms and conditions should apply in order to maximize the subsidy budget. A higher amount of subsidy per square meters in the south of Limburg would, for example, be necessary to compensate for the higher costs of the measures in order to receive more applicants.

Reduce the administration of the subsidies

Another improvement in the subsidy system is the organization of the processes. At a provincial level the province could rearrange their subsidy system. Because of a shortage in the human capacity within municipalities, the lowering of the administration for accountability is preferred by many municipalities. The province could introduce a contribution system in future subsidies, where the province gets more involved from the beginning of the projects and therefore can reduce the administration afterwards.

Organization of climate adaptation

Administrative agreement necessary to ensure climate adaptation in other domains

The inclusion of climate adaptation in the everyday tasks of civil servants next to the water civil servant is still often not implemented. Therefore, first of all, a research will be necessary to create an overview of all the linking opportunities. A lesson learned from the province of Brabant and Gelderland is that these other domains will not discover these linking opportunities by themselves. When these linking opportunities are discovered and other domains know which climate adaptive measures they have to implement, an administrative agreement should be made to ensure climate adaptation within all departments. The province of Gelderland and Noord-Brabant expressed this is necessary as the environmental vision or internal risk dialogues are not sufficient to guarantee that other domains implement climate adaptation.

Creating a mixed team

A follow up step is to start working on climate adaptation outside of the existing water cooperation's and create a multi-disciplinary team, following the example of Parkstad and Gelderland. This will ensure an active involvement of other domains and interests and more diverse strategies within climate adaptation. Currently, these mixed teams experience the difficulty of the resources being mostly intended for water related measures. A prerequisite for this team to function effectively and achieve its full capacity is the decompartmentalization of the budgets in order to be able to implement other measures than water related ones.

Legal instruments within climate adaptation

Legal instruments are not enforcing enough

Finally, the legal instruments that are implemented within climate adaptation mostly consists of more advisory instruments than actually restricting certain non-climate adaptive activities. An example is the water test which mostly serves as an advice from the water authority which can possibly be disregarded by project developers. In addition, currently no rules or legal instruments exist for green or heat stress related measures. Without climate adaptation being legally embedded it is hard for the province or municipalities to ensure climate adaptation within new projects.

Improvements in the legal instruments

A multitude of ideas and possible instruments exists within the legal instruments. Governments would prefer to structure, rule and regulate climate adaptation, in which municipalities emphasize the importance of including green measures as well. This can be done in several manners such as rules in municipal and provincial ordinances, a building covenant or including performance agreements. The water authority and the province would prefer a legal instrument that would enforce climate adaptation enough to prevent non-climate adaptive building. However, municipalities want to emphasize that climate adaptive building should not mean not building at all at specific locations. A decision still has to be made upon which legal instrument will be implemented. Preferably, this has to be a climate adaptive rule or regulation in a national building code, provincial ordinance or municipal ordinance to prevent non-climate adaptive building.

Conclusion to the main research question

An overall conclusion can be drawn that there are multiple constraining factors which derive from the policy arrangement. These factors influence the policy instruments and can lead to inefficient policy instrument usage. Momentarily, the current policy instrument mix mostly contains water related policy instruments, which are fragmented and appointed to separate goals. These instruments are mostly situated in the information, communication and economic policy instruments than in enforcing rules, regulations or structures. Combining these different instruments, especially budgets from higher level governments, proved to be unpractical as the bureaucratic system is so overly complicated that lower level governments do not or cannot use budget synergies. In order to create an all-encompassing policy instrument mix the connection with heat stress and other linking opportunities should be made, budgets should be decompartmentalized and instead of mainly focusing on the treatment of symptoms, prevention of future non-climate adaptive actions has to be embedded in provincial and municipal regulation.

7. Discussion

This chapter will contain the reflection on the theory, the reflection on the methodology and recommendations for praxis.

7.1 Reflection on theory

The applied theories in this research consist of the policy arrangement and the policy instruments theories.

Contribution to theory

As described in theory, the policy arrangement contains certain practices, habits, visions and opinions within a policy domain that have become 'institutionalized', 'patterned' and 'integrated' in everyday policy practice (Wiering & Immink 2009). The policy arrangement and its four categories were a useful starting point to describe the institutional context. The concepts within the theory were found to contain some fundamental obstacles which influenced the policy instrument usage. The resources physical features and space for climate adaptive measures are additional factors that are important to include within the conceptual model of the policy arrangement. It is important to take this category into account as it will change the strategy of the actor and decides the different starting points of municipalities climate adapting their environment. When more complicated bottlenecks are situated in the municipality, or if the municipality mostly consists of urban area, the complexity, and therefore the costs and amount of measures, increases.

Another obstacle that is not included in the policy arrangement is the lock-in situation of the sewage system. Upscaling the restructurings to disconnect from the sewage is not possible because of the depreciation period and the high costs of adaptation. Therefore a path dependent system is developed. Sydow et al. (2009) argue that in policy processes, commitments are made to an organizational path which (un)intentionally determine decisions in a certain direction, creating organizational lock-ins in which other options are no longer available. The variable path dependency could therefore be introduced within the policy arrangement.

Policy instruments theory

Theory researching the policy instrument mix is complex with no one-size-fits-all approach, where tailor-made mixes of instruments attuned to the context is necessary in each case (Termeer et al., 2017). The policy instruments theory was found to be a solid foundation which included every possible policy instrument that could be implemented. When implementing this theory in practice it was quickly discovered that the theory first needed a local operationalization of the policy instruments. The broadness of the theory and its operationalization was not applicable in practice, as testing the operationalization with the civil servants from the province and municipality proved the items were too abstract. The local translation makes the research less generally applicable, as the policy instrument mix is specifically designed for Limburg. In addition, some policy instruments overlap the categories and contribute to multiple categories. Therefore praxis does not always let itself be categorized as reality is more complex.

Recommendation future research

Next to the practical research recommendations one scientifically interesting research topic kept reappearing during the collecting of data; the effect of the flooding in the south of Limburg of 2021. This topic was considered to get included within this research but it was too early to research the effects of the flooding on the policy instruments, as many actors were still in their evaluation phase during data collection. Ideas started to emerge during the duration of the internship to prevent

future flood events. Future research could therefore focus on the effects of this flood event within the policy arrangement and in the policy instruments to measure the response to the event and evaluate if Limburg is actually changing towards a more climate adaptive environment.

7.2 Reflection on methodology

Every research contains its limitations. The most prominent limitations within the methodology will be the subject of this paragraph.

Operationalization policy instruments

The local policy instrument mix had to be operationalized further in order to create an overview before starting the research. The policy instruments have been operationalized in a constructive manner. Several civil servants from the province, one civil servant of a municipality (Beesel) and policy documents from municipalities, have contributed to operationalizing the policy instruments. Later discovered frequently used policy instruments were added to the policy instrument mix. However, not every policy instrument has been analyzed as only a few municipalities have implemented these policy instruments. An example is the green façade and roofs subsidy which only exists in Sittard-Geleen and Peel and Maas. The decision was made to include the most implemented policy instruments as the case study contains the whole province of Limburg.

Including other civil servants

This research has mainly been conducted within the water domain, referring to most respondents working in water related fields. This choice has been made because of the framing of climate adaptation as a water theme by the governments themselves and climate adaptation being organized within the water domain. However, the missing or malfunctioning policy instruments could be interpreted differently by civil servants working in other domains such as infrastructure or housing. When repeating the same research in other policy domains other instruments could be perceived as missing or malfunctioning.

Including other stakeholders

Another limitation is only including the three governmental levels. Whether a policy instrument is effective or malfunctioning may be interpreted differently by other actors such as the LLTB, inhabitants or nature organizations. Future research could therefore be conducted with the external stakeholders and with other policy domains.

7.3 Recommendations for praxis

The overall recommendations for praxis are the subject of this paragraph. The improvements and recommendations within the separate policy instruments can be found in the table situated in paragraph 5.4.

Broaden the national climate adaptation definition

As mentioned before, the definition of climate adaptation on a national level had a series of effects which caused climate adaptation being a predominantly water related policy arrangement. Including green and heat stress related measures in the national definition will increase the involvement of these themes, both within the organizational as in the economical instruments.

Structure the climate adaptive measures

Municipalities express the need to develop a structure to base their decisions upon. This refers to one overview containing the effects, costs and benefits of climate adaptive measures. This is

necessary to structure the choices incorporating climate adaptation in spatial plans better. Currently, a general overview does not exist, with the biggest knowledge lacuna being within heat stress. Research within heat stress is therefore necessary whereafter an overview and decision making structure can be created.

Research the linking opportunities

In addition, the linking opportunities external to the water domain should be researched. A dominant discourse is to implement climate adaptation by using linking opportunities. What these exact linking opportunities are in practice is often not clear. Therefore climate adaptation is not always implemented in these other domains which could be improved by this research.

Arrange more green and destoning actions

The survey showed only 30 percent of the municipalities include green or destoning actions within their communication instruments. These are relatively easy to implement measures that have many existing structures and ideas of how to implement them. Tile-swiping competitions, green festivals or online gardening courses are examples of how to improve these kind of actions.

Improve the meeting structure and communication between governments

Within governments the miscommunication became apparent during the internship. Because of a lack of time and because of over structuring the meetings many civil servants do not have the time to attend all of the meetings. This has resulted in miscommunications about various policy instruments that could have been avoided. Restructuring the meetings and creating more human capacity will mainly solve this problem.

Organize climate adaptation next to water

In the organizational instruments the water related focus became apparent. The water civil servant has less of a policy related focus which, at the moment, climate adaptation needs in order to create strategies. Second, the water civil servant has an unreliable schedule and has a shortage of hours to invest in climate adaptation. Therefore climate adaptation could be improved by including a more policy related civil servant which creates extra human capacity as well.

Create more flexible terms and conditions

Subsidies and other manners of funding often had restricting terms and conditions. The lack of the opportunity to use synergies within the different sources of funding is the main point of concern. The compartmentalizing of budgets have increased the bureaucracy for both municipalities and inhabitants. The goals of the different sources of funding could be broadened or merged together to create one climate adaptive arrangement that also encourages green measures.

Regulate climate adaptation

The majority of ideas within regulating climate adaptation all refer to including more rules to incorporate and enforce climate adaptation. First of all, within the governmental organizations an administrative agreement is necessary to ensure climate adaptation in all different policy domains. Second, rules about climate adaptive building such as disconnection from the sewage, green percentages, heat stress reducing measures and manners of building should be combined in a legal instrument. This should preferably be an instrument that cannot be avoided by arguments to not include climate adaptation. An example is the national building code, the municipal rainwater ordinance or a provincial instruction rule.

8. References

- Acciai, C., & Capano, G. (2021). Policy instruments at work: a meta-analysis of their applications. *Public Administration*, 99(1), 118–136. <https://doi-org.ru.idm.oclc.org/10.1111/padm.12673>
- Arts, B., Leroy, P., & Van Tatenhove, J. (2006). Political modernisation and policy arrangements: a framework for understanding environmental policy change. *Public organization review*, 6(2), 93-106.
- Arts, B & Leroy, P. (2003). *Institutional Dynamics in environmental governance*, Dordrecht: Springer, 45-68.
- Arts, B. & Leroy, P. (2006). Institutional dynamics in environmental governance. In *Institutional dynamics in environmental governance*. Dordrecht: Springer, 1-19.
- Bali, A. S., Capano, G., & Ramesh, M. (2019). Anticipating and designing for policy effectiveness. *Policy and Society*, 38(1), 1-13
- Begg, C. (2018). Power, responsibility and justice: a review of local stakeholder participation in European flood risk management. *The International Journal of Justice and Sustainability*, 23(4), 382-397. <https://doi.org/10.1080/13549839.2017.1422119>
- Benz, A. (2006). Governance in Mehrebenensystemen. *Governance-Forschung. Vergewisserung über Stand und Entwicklungslinien*. 2. Auflage, Schuppert GF (ed.). Baden-Baden: Nomos; 95–120
- Burkas, V., & Sallnäs, O. (2012). Forest management plan as a policy instrument: carrot, stick or sermon? *Land Use Policy*, 29(3), 605-613.
- Capano, G., & Howlett, M. (2020). The knowns and unknowns of policy instrument analysis: Policy tools and the current research agenda on policy mixes. *Sage Open*, 10(1), 2158244019900568.
- Corry, O. (2017). The international politics of geoengineering: The feasibility of Plan B for tackling climate change. *Security Dialogue*, 48(4), 297-315.
- Di Gregorio, M., Fatorelli, L., Paavola, J., Locatelli, B., Pramova, E., Nurrochmat, D. R., ... & Kusumadewi, S. D. (2019). Multi-level governance and power in climate change policy networks. *Global environmental change*, 54, 64-77.
- Eckerberg, K., Joas, M. (2004). Multi-level Environmental Governance: a concept under stress? *Local Environment*, 9(5), 405-412.
- Füssel, H. M. (2007). Adaptation planning for climate change: concepts, assessment approaches, and key lessons. *Sustainability Science*, (2) 2, 265–275.
- Giddens, A. (1984). *The constitution of society. Outline of the Theory of Structuration*. Cambridge: Polity Press.
- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105-117). Thousand Oaks, CA: Sage.
- Henstra, D. (2016). The tools of climate adaptation policy: analysing instruments and instrument selection. *Climate Policy*, 16(4), 496-521.
- Hooghe, L. (2001). Types of Multi-Level governance. *European Integration Online Papers*.

- Hughes, S., 2017. The politics of urban climate change policy: toward a research agenda. *Urban Affairs Review*, 53(2), 362–380.
- Immink, I. (2005). Established and recent policy arrangements for river management in The Netherlands: an analysis of discourses. *Landscape Research to Landscape Planning: Aspects of Integration, Education and Application*, pp. 387-404.
- IPCC. (2018). Annex I: Glossary [Matthews, J.B.R. (ed.)]. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press
- Kaufmann, M., Lewandowski, J., Choryński, A., & Wiering, M. (2016). Shock events and flood risk management: a media analysis of the institutional long-term effects of flood events in the Netherlands and Poland. *Ecology and Society*, 21(4).
- Kaufmann, M., & Wiering, M. (2021). The role of discourses in understanding institutional stability and change—an analysis of Dutch flood risk governance. *Journal of Environmental Policy & Planning*, 1-20.
- Klein, R. J. (2011). Adaptation to climate change. *Climate*, 157-168.
- Korzilius, H. (2008). *De kern van surveyonderzoek*. Assen: Van Gorcum.
- Leroy, P., Arts, B. J. M., & van Tatenhove, J. P. M. (2003). Verandering en continuïteit in milieubeleid: een kader voor analyse en duiding. *Verandering van politiek, vernieuwing van milieubeleid*, 5-30.
- Lesnikowski, A., Biesbroek, R., Ford, J. D., & Berrang-Ford, L. (2021). Policy implementation styles and local governments: the case of climate change adaptation. *Environmental Politics*, 30(5), 753-790.
- Liefferink, D. (2006). The Dynamics of Policy Arrangements: Turning Round the Tetrahedron. *Institutional Dynamics in Environmental Governance* (pp. 45-68). Dordrecht: Springer.
- Mattijssen, T. J. M., Buijs, A. E., Elands, B. H. M., & Van Dam, R. I. (2015). De betekenis van groene burgerinitiatieven (No. 127). *Wettelijke Onderzoekstaken Natuur & Milieu*.
- Mees, H. L., Dijk, J., van Soest, D., Driessen, P. P., van Rijswijk, M. H., & Runhaar, H. (2014). A method for the deliberate and deliberative selection of policy instrument mixes for climate change adaptation. *Ecology and Society*, 19(2).
- Moser, S. C., & Ekstrom, J. A. (2010). A framework to diagnose barriers to climate change adaptation. *Proceedings of the national academy of sciences*, 107(51), 22026-22031.
- Ministerie van Infrastructuur en Waterstaat, Ministerie van Landbouw, Natuur en Voedselkwaliteit & Ministerie van Binnenlandse Zaken en Koninkrijksrelaties. (2020). *Deltaprogramma 2021. Ruimtelijke adaptatie*. Den Haag: Staf Deltacommissaris.
- Mintrom, M., & Norman, P. (2009). Policy entrepreneurship and policy change. *Policy studies journal*, 37(4), 649-667.

- Moens, M. (2019). *Integraal waterplan regio Parkstad Limburg*. 's-Hertogenbosch: Arcadis.
- Municipality of Horst aan de Maas. (2022). *Uitvoeringsprogramma gemeente Horst aan de Maas*. Unpublished
- Municipality of Roerdalen. (2022). *Uitvoeringsprogramma gemeente Roerdalen*. Unpublished
- Municipality of Venlo. (2022). *Uitvoeringsprogramma gemeente Venlo*. Unpublished
- Osborne, S. P. (2006). Editorial: The New Public Governance. *Public Management Review* (8)3, 377-387.
- Pierre, J. (2000). Introduction: understanding governance. *Debating Governance Authority, Steering and Democracy*, Oxford: Oxford University Press.
- Provincie Limburg. (2021). *Provinciaal Waterprogramma 2022-2027*. Retrieved from: <https://limburg.bestuurlijkeinformatie.nl/Agenda/Document/64e5a2cd-1234-4947-833d-144bb4bb5bc9?documentId=b3b85ad7-4268-47e3-832f-3bf26fdd6463&agendaltemId=6241670a-e09c-4d46-a288-13415fc4aced>
- Provincie Limburg. (2020). *Omgevingsvisie*. Retrieved from: <https://www.limburg.nl/onderwerpen/omgeving/omgevingsvisie/>
- Reckien, D., (2015). The influence of drivers and barriers on urban adaptation and mitigation plans—an empirical analysis of European cities. *Plos One*, 10(8), e0135597.
- Regio Maas- en Mergelland. (2021). *Uitvoeringsagenda Maas- en Mergelland*. Unpublished
- Regio Waterpanel Noord. (2021). *Regionale uitvoeringsagenda Waterpanel Noord*. Retrieved from: <https://sway.office.com/LScFyuGAZGuGGibD>
- Roumen, J. (2021). *Het klimaat verandert*. Retrieved from: <https://www.waterklaar.nl/maas/nieuws/2021-03-31/op-weg-naar-een-klimaatadaptieve-regio-in-2050>
- Runhaar, H., Mees, H., Wardekker, A., Sluijs, J. v., & Driessen, P. (2012). Adaptation to climate change-related risks in Dutch urban areas: stimuli and barriers. *Regional Environmental Change*, 12 (4), 777-790.
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students*. Pearson education.
- Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research methods. Business Students. 8th edition*. Pearson education
- Schreurs, J. (2021). *Wateroverlast Limburg is nationale ramp*. Retrieved on: 16-10-2021, from <https://www.1limburg.nl/wateroverlast-limburg-nationale-ramp>
- Sydow, J., Schreyögg, G., & Koch, J. (2009). Organizational Path Dependence: Opening the Black Box. *Academy of Management Review*, 34(4), 689-709. <https://doi.org/10.5465/AMR.2009.44885978>
- Te Grotenhuis, M., & Matthijssen, A. (2009). *Basiscursus SPSS*. Versie 15-17. Assen: Van Gorcum.
- Ter Horst, R. & Leusink, E. (2021). *Beleidsplan water & klimaatadaptatie. Voor de periode 2022-2027*. Sittard: Westelijke Mijnstreek.

- Termeer, C., Dewulf, A., van Rijswijk, H., van Buuren, A., Huitema, D., Meijerink, S., Rayner, T. and Wiering, M. (2011). The Regional Governance of Climate Adaptation: A Framework for Developing Legitimate, Effective and Resilient Governance Arrangements, *Climate Law*, (1), 1-21
- Termeer, C., Van Buuren, A., Dewulf, A., Huitema, D., Mees, H., Meijerink, S. V., & van Rijswijk, M., (2017). Governance Arrangements for the Adaptation to Climate Change. *Oxford Research Encyclopedia of Climate Science*, 1-31
- Van Buuren, A., Edelenbos, J., & Klijn, E. H. (2010). *Gebiedsontwikkeling in woelig water: Over water governance bewegend tussen adaptief waterbeheer en ruimtelijke besluitvorming*. Den Haag: Boom Lemma.
- Van Esch, K. J., Leusink, E., & van Riel, W. (2017). *Waterplan Maas- en Mergelland 2018-2022*. Eijsden-Margraten: Sweco.
- Van Tatenhove, J., Arts, B. & Leroy, P. (2000). *Policy arrangements*. In *Political modernisation and the environment*. pp. 53-69. Dordrecht: Springer.
- Van Tatenhove, J. P. (2017). Transboundary marine spatial planning: a reflexive marine governance experiment?. *Journal of Environmental Policy & Planning*, 19(6), 783-794.
- Veenman, S., Liefferink, D., & Arts, B. (2009). A short history of Dutch forest policy: The 'de-institutionalisation' of a policy arrangement. *Forest Policy and Economics*, 11(3), 202-208.
- Vennix, J. (2012). *Theorie en praktijk van empirisch onderzoek*. Harlow: Pearson Custom Publishing.
- Verschuren, P., & Doorewaard, H. (2007). *Het ontwerpen van een onderzoek*. Den Haag: Uitgeverij Lemma.
- VROM-raad. (2007). *De hype voorbij. Klimaatverandering als structureel ruimtelijk vraagstuk*. Den Haag: VROM-raad.
- Waterschap Limburg. (2021). *Waterbeheerprogramma 2022-2027 ontwerp*. Retrieved from: https://www.waterschaplimburg.nl/publish/library/63/wl_waterbeheerprogramma_2022-2027_liggend_a4_isoproof_toegankelijk_11-2021.pdf
- Wiering, M. A., & Arts, B. J. M. (2006). Discursive shifts in Dutch river management: 'deep' institutional change or adaptation strategy?. *Living rivers: trends and challenges in science and management* (pp. 327-338), Dordrecht: Springer.
- Wiering, M. A., & Immink, I. (2009). Nieuwe beleidsarrangementen voor waterbeheer en ruimtelijke ordening? *Water en Ruimte*. SDU Uitgevers bv, The Hague (in Dutch): 183–196.
- World Weather Attribution. (2021). *Heavy rainfall which led to severe flooding in Western Europe made more likely by climate change*. Retrieved from: <https://www.worldweatherattribution.org/heavy-rainfall-which-led-to-severe-flooding-in-western-europe-made-more-likely-by-climate-change/>

Appendix

Appendix A Overview data collection

Reference	Date	Organization	Function
Interview 1	26-10-2021	Province of Noord-Brabant	Civil servant climate adaptation
Interview 2	29-10-2021	Province of Noord-Brabant	Civil servant climate adaptation
Interview 3	4-11-2021	Province of Gelderland	Civil servant climate adaptation
Interview 4	18-11-2021	Municipality of Beesel	Alderman
Interview 5	19-11-2021	Province of Limburg	Provincial depute
Interview 6	23-11-2021	Municipality of Maastricht	Civil servant housing and climate adaptation
Interview 7	24-11-2021	Municipality of Venlo	Alderman
Interview 8	1-12-2021	Municipality of Roermond	Alderman and civil servant water
Interview 9	1-12-2021	Province of Limburg	Civil servant drought and civil servant climate adaptation
Interview 10	3-12-2021	Municipality of Simpelveld	Alderman and civil servant water
Interview 11	14-12-2021	Province of Limburg	Head of the cluster water and nature
Interview 12	2-12-2021	Province of Limburg	Civil servant subsidies (one million trees plan)
Interview 13	6-12-2021	Municipality of Roerdalen	Alderman and civil servant water
Interview 14	6-12-2021	Waterklaar	Project leader private terrains Waterklaar
Interview 15	7-12-2021	Municipality of Weert and region Waterpanel Noord	Regional coordinator climate adaptation Waterpanel Noord
Interview 16	8-12-2021	Municipality of Beek and region Parkstad	Regional coordinator climate adaptation Parkstad
Interview 17	9-12-2021	Water authority Limburg	Civil servant strategy climate adaptation
Interview 18	13-12-2021	Water authority Limburg	Civil servant urban water (disconnection from the sewage subsidy)
Interview 19	15-12-2021	Municipality of Sittard-Geleen & region Westelijke Mijnstreek	Regional coordinator climate adaptation Westelijke Mijnstreek
Interview 20	21-12-2021	Royal Haskoning	Regional coordinator climate adaptation Maas en Mergelland
Interview 21	22-12-2021	Municipality of Simpelveld	Civil servant water, civil servant infrastructure & civil servant energy transition
Interview 22	22-12-2021	Municipality of Roerdalen	Civil servant water
Interview 23	12-1-2022	Municipality of Meerssen, southern work regions	Coordinator southern water work regions
Interview 24	20-1-2022	Municipality of Beesel	Civil servant water, civil servant climate adaptation and civil servant green
Interview 25	20-1-2022	Municipality of Venlo	Civil servant water, civil servant climate adaptation and civil servant green
Interview 26	1-2-2022	Province of Limburg	Manager water department and regional water system & civil servant main water system
Observations		Subject	

Ambtelijke Klimaat Adaptatietafel Limburg	Proceedings within the different work regions, the new water nuisance table, a presentation of the ministry about climate adaptation
Bestuurlijke Klimaat Adaptatietafel Limburg	Main subject: the flooding of last summer, what have we learned, personal experiences of aldermen of Kerkrade, Valkenburg and Roermond.
Brainstorm session Parkstad Limburg	Brainstorm session with the Parkstad region and operatie Steenbreek about how to continue the greening projects within the region
Meeting water region Limburgse Peelen Venlo – Venray	Meeting about all water related subjects within the region, including climate adaptation
Meeting climate adaptation region Parkstad	Meeting about their implementation program. Discussing the text within this program
Meeting water region Westelijke Mijnstreek	Discussing the new rainwater disconnecting table, including introduction by province and water authority. Updates about several subjects including climate adaptation

Documents
Region Maas en Mergelland, Uitvoeringsagenda, 2021
Region Waterpanel Noord, Uitvoeringsagenda, 2021
Region Parkstad, 90 Procent versie Uitvoeringsagenda, 2022
Gemeente Horst aan de Maas, Implementatieprogramma, 2022
Gemeente Venlo, Implementatieprogramma, 2022
Gemeente Roerdalen, Implementatieprogramma, 2022
Province of Limburg, Provinciaal Waterprogramma 2022-2027, 2022
Province of Limburg, Omgevingsvisie, 2020
Water Authority Limburg, Waterschapsbeheerprogramma 2022-2027, 2021

Appendix B Conclusion provincial report

Binnen dit onderzoek is beoogd om de volgende hoofdvraag te beantwoorden: *Welke rol zou provincie Limburg kunnen vervullen zodat gemeenten klimaatadaptatie succesvol kunnen inbedden?*

Een eerste rol die de provincie Limburg op zich zou kunnen nemen is een stimulerende rol. Volgens gemeenten en regiotrekkers zijn op drie vlakken verbeteringen mogelijk: Dit is, ten eerste, een provinciale financiële impuls binnen groenprojecten, zowel binnen openbare als private ruimten. Ten tweede zouden waterprojecten in het zuiden van Limburg een impuls kunnen gebruiken om meer en grotere waterprojecten uit te kunnen voeren. Ten derde zou de provincie zich kunnen aansluiten bij de behoefte van gemeenten en waterschap Limburg om zelfredzaamheid van inwoners te stimuleren. Een laatste belangrijk aandachtspunt is het uitbreiden van de afkoppelsubsidie zodat groen en biodiversiteit ook binnen deze al bestaande regeling opgenomen zou kunnen worden. Hier zou samenwerking met het waterschap en gemeenten in gevonden kunnen worden.

Een tweede rol die provincie Limburg volgens de gemeenten zou kunnen invullen is het faciliteren van kennis binnen hittestress waar nog kerngetallen en informatie worden gemist om maatregelen te implementeren. Daarnaast zou de provincie mee kunnen financieren aan een proeftuin in Sittard-Geleen om de praktische knelpunten in kaart te brengen binnen gemeenten waar andere gemeenten ook van kunnen leren. Tevens wordt er een groot tekort aan personeel ervaren binnen gemeenten waardoor projecten stil komen te liggen. Waar mogelijk zouden provinciale ambtenaren taken over kunnen nemen van gemeenten, administratie proberen te verminderen en projecten meer kunnen trekken vanuit de provincie. Ten slotte zou provincie Limburg samen op kunnen trekken met de regionale projecten die door de werkregio's zijn opgesteld. Zowel financiële als personele ondersteuning zouden hierin welkom zijn.

De derde rol die provincie Limburg op zou kunnen pakken is het regisseren en verankeren van klimaatadaptatie. Ten eerste mist hier volgens de gemeenten een koers of kaderdocument met welke onderwerpen binnen klimaatadaptatie in het stedelijk gebied de provincie Limburg aan de slag zou willen gaan en hoe zij dit zou willen bereiken. Daarnaast bestaat er een veelvoud aan ideeën binnen gemeenten hoe klimaatadaptatie verankerd zou moeten worden in beleid en regelgeving en op welk schaalniveau dit zou moeten gebeuren. Het opnemen van een provinciale motiveringsparagraaf klimaatadaptatie in de Provinciale Omgevingsverordening werd door de meeste gemeenten gesteund. Er zou ook nagedacht kunnen worden om op provinciaal schaalniveau een convenant klimaatbestendig bouwen op te stellen waardoor andere partners gelijk verbonden zijn aan de afspraken die hierin worden opgenomen.

De vierde, en laatste, rol binnen klimaatadaptatie is het verbinden en verspreiden. Om kennis uit te wisselen tussen regio's en gemeenten zou de provincie het overzicht kunnen behouden binnen de regio's. In de praktijk bleken verschillende regio's met dezelfde onderwerpen en barrières te kampen maar zijn zij niet altijd van elkaars opgaven en problemen op de hoogte. Daarnaast is de integraliteit binnen de gemeenten en de provincie zelf nog niet optimaal. Andere clusters, naast water en natuur, zijn vaak niet op de hoogte wat zij kunnen betekenen binnen klimaatadaptatie. Deze meekoppelkansen zouden in beeld gebracht kunnen worden. Nadat deze kansen bekend zijn zouden er door de provincie sessies gehouden kunnen worden binnen de bestaande overlegstructuren, zoals klimaatadaptatie in de energietransitie, zodat gemeentelijke ambtenaren binnen deze sectoren begrijpen waar zij het verschil kunnen maken. Ten slotte zou er samen met gemeenten en regio's gekeken kunnen worden waar de overbezette water overlegstructuur verbeterd zou kunnen worden. Deze verbeteringen in de vier benoemde rollen zouden door provincie Limburg, binnen het beschikbare budget en personele capaciteit, verder uitgewerkt en doorontwikkeld kunnen worden.

Appendix C Operationalization climate adaptive instruments

Operationalization of climate adaptive policy instruments. This list has been conducted in cooperation with provincial and municipal civil servants.

Information and communication tools

- Stress tests: information and visualization of the impact of drought, heat stress, flooding and water nuisance within own municipality and region.
- Risk dialogues: communication with stakeholders about bottlenecks that emerged during the stress tests and how to resolve them together.
- Water related research
- Other research outside of the stress tests and dialogues.
- (Online) Portal for sharing information and gained knowledge and practical experience within the province or region. (waterinlimburg.nl)
- Facilitate communication between parties.
- Inform residents, businesses, farmers and other actors about the risk of flooding, drought, heat stress and floods to create awareness of these problems. This can be done through publications, leaflets and meetings.
- Advise residents and businesses on what climate adaptive measures they can implement and what subsidies and opportunities are available. This can be done through leaflets or customization.
- Showcases, communication actions and information actions of municipalities. Such as the house of tomorrow in Venlo showcasing the possible climate adaptive measures, information sessions about gardening and gardening festivals.
- Waterklaar: main communication instrument in Limburg (linked to the disconnection of the sewage subsidy)
- Province: LIWA (predicting climate adaptive scenarios), Deltares research (water related measures developed after the flooding)
- Water authority: Water in Balans (pilots for drought and water nuisance / flooding), background knowledge for drought (Room for the Brook), technical reports and measuring, and plenty of water related climate adaptive knowledge.

Legal instruments

Province

Climate adaptation can be anchored within:

- Environmental vision or other vision
- Climate adaptation program (water program)
- Provincial ordinance

Instruments:

- Provincial ordinance: instruction rules
- Leases
- Licensing
- Climate adaptation in contracts and tenders
- Covenants
- Expropriation of land for climate adaptive measures
- Flood norm water authority
- Project decisions

Municipality

Climate adaptation can be anchored within:

- Environmental vision or other vision
- Climate adaptation implementation program
- Zoning plan / environmental plan
- Operating plan
- Anterior agreement
- Municipal sewage and water plan / program
- Performance agreements with housing corporations

Instruments:

- Include rules to promote climate adaptation within zoning plans / environment plans
- Include rules to promote climate adaptation within operational plans or anterior agreements
- Municipal ordinance: include climate adaptation in rules for discharging groundwater and rainwater
- Climate adaptation in contracts and tenders
- Covenants
- Expropriation of land for the purpose of climate adaptation measures
- Performance agreements with housing corporations

Water authority

- Water management program
- Water Test
- Keur and general rules. The rules of the water authority about activities that have consequences for the regional water system. These are general rules, standards and guidelines.
- Water authority ordinance (successor to Keur)
- Project decision
- Expropriation of land for climate adaptive measures

Economic instruments

National government:

- Impulse regulation DPRA (covers 1/3 of the costs)
- HWBP (fund for dyke reinforcement and high water protection)
- DHZ subsidy (covers 25 percent of costs)

Province

- Million tree subsidy
- Provide subsidy for municipal / regional / private projects
- Directly invest in climate adaptation / water programs
- Invest in making own public property climate adaptive
- Contribution arrangements
- Write-offs / depreciation
- Damage compensation
- Agricultural subsidies: POP-3

Municipality

- Invest directly in climate adaptation / water programs
- Invest in making own public property climate adaptive
- Provide subsidy for residents and businesses
- Sewage tax
- Lower the WOZ tax; if climate adaptive measures are implemented, such as disconnecting or reducing the paved surface.
- Tile tax: levy for paved surfaces

Water authority

- Water authority tax
- Invest directly in programs
- Provide subsidies for municipalities
- Creator / responsible of the disconnection of the sewage subsidy
- Agricultural subsidy: changing the manner of farming

Organizational instruments

- Raise awareness among colleagues about the theme of climate adaptation
- Integral working: deploy a multidisciplinary team to promote integral working / implementation of climate adaptation within all domains (housing, energy transition, etc.)
- Integral working: reach agreement within the province or municipality that all other domains will also include climate adaptation.
- Organize / participate in climate table
- Have someone responsible for the integral way of working within governments

Appendix D Survey questions

Hoe hoog is de urgentie binnen uw gemeente om met de volgende onderwerpen binnen de volgende onderwerpen?

Field	Mean	Responses
Overstromingen	5.67	27
Wateroverlast	8.04	27
Droogte	6.04	27
Hittestress	5.33	27

Welke van de volgende kennis instrumenten zijn er toegepast binnen uw gemeente? (Meerdere antwoorden mogelijk)

- Stresstesten waarmee er overzicht is binnen alle vier de klimaatadaptieve onderwerpen (overstroming, wateroverlast, droogte en hittestress)
- Stresstesten met uitwerking van de knelpunten
- Onderzoek naar mogelijke toekomstscenario's betreffende klimaatverandering
- Onderzoek naar mogelijke klimaat adaptieve maatregelen binnen de gemeente
- In contact staan met inwoners en informatie ophalen over klimaatadaptatie (ervaringen wateroverlast, hittestress etc.)
- Anders:
- Opgedane kennis binnen de eigen gemeente delen met andere gemeenten
- De stresstesten worden binnen onze gemeente gebruikt bij nieuwe ruimtelijke ontwikkelingen
- De voorkeurstabel afkoppelen wordt binnen onze gemeente gebruikt bij nieuwe ruimtelijke ontwikkelingen
- Een vorm van klimaateducatie aanbieden op scholen
- Kosten baten analyses van maatregelen
- Educatie van stratenmakers en hoveniers over klimaatadaptieve inrichting

Welke van de volgende communicatie instrumenten zijn er toegepast binnen uw gemeente? (Meerdere antwoorden mogelijk)

- Risicodialogen: communicatie met stakeholders over knelpunten die naar voren kwamen tijdens de stresstesten en hoe deze gezamenlijk op te lossen
- Informeren van inwoners, bedrijven, boeren en andere actoren over wateroverlast, droogte, hittestress en overstromingen om bewustzijn te creëren over deze problemen
- Adviseren over welke klimaat adaptieve maatregelen inwoners en bedrijven kunnen implementeren en welke subsidies en mogelijkheden er beschikbaar zijn
- Partijen aanmoedigen om te ontsteden (promotie NK tegelwippen, operatie steenbreek, tegels gratis ophalen etc.)
- Partijen aanmoedigen om te vergroenen (samenwerking met tuincentra, korting op beplanting, cursus tuinieren aanbieden)
- Anders:
- Partijen aanmoedigen om af te koppelen (bijv. Waterklaar promoten)

- Klimaatadaptatie opnemen in gemeentelijke social media
- Met burgers in contact komen over klimaatadaptatie (markten, bijeenkomsten, infoavonden etc.)
- Collega's bewust maken over het thema klimaatadaptatie
- Op de hoogte blijven over klimaatadaptatie (cursussen volgen, artikelen lezen etc.)
- Klimaatadaptatie opnemen binnen contracten en aanbestedingen
- Klimaat meenemen bij de inkoop voor de gemeente
- Integraal werken: een programmamanager aanwijzen om integraal werken te bevorderen binnen alle domeinen (wonen, energietransitie etc.) en klimaatadaptatie hierin meenemen

Welke van de volgende organisatorische instrumenten zijn er toegepast binnen uw gemeente?
(Meerdere antwoorden mogelijk)

- Integraal werken: bestuursakkoord of gedeelde visie bereiken binnen de gemeente zodat alle andere domeinen klimaatadaptatie ook zullen opnemen
- Integraal werken: gebiedsgericht werken
- Klimaatadaptatie wordt op een andere manier integraal meegenomen
- Geen van bovenstaande opties
- Anders:

Welke van de volgende investeringen (vanuit de eigen begroting) worden er gedaan binnen uw gemeente? (Meerdere antwoorden mogelijk)

- Investeren in groen blauwe schoolpleinen
- Investeren in het klimaatadaptief maken van de gemeentelijke panden (gemeentehuis, sportaccommodaties, scholen etc.)
- Investeren in het scheiden van het riool (afvalwater en hemelwater)
- Investeren in bovenstroomse afremming (beplanting, civiele oplossingen)
- Investeren in het vergroenen van de openbare ruimten
- Investeren in het verminderen van hittestress door kleurgebruik en materiaalgebruik aan te passen
- Investeren in klimaatadaptieve infrastructuur (wegen, fietspaden etc.)
- Investeren in het vergroten van de capaciteit van het riool
- Investeren in het vernieuwen van draaiboeken tijdens calamiteiten en waarschuwingssystemen
- Investeren in overstromingsmaatregelen (stuwen, opvangbekkens, buffers, wadi's)
- Investeren in het afkoppelen van de openbare ruimten
- Investeren in het ontsteden van het publiek bezit (grote parkeerplaatsen groen doorlatende verharding aanleggen bijv.)
- Investeren in het vergroenen van particuliere ruimten (Ik groen het bijv.)
- Investeren in het verminderen van hittestress
- Investeren in maatregelen tegen (bos)branden
- Investeren in bewustwordingscampagne
- Geen van bovenstaande opties
- Weet ik niet
- Anders:

Welke van de volgende subsidies worden toegepast binnen uw gemeente om klimaatadaptatie te bevorderen? (Meerdere antwoorden mogelijk)

- Subsidie verstrekken voor groene gevels / daken
- Stimuleringsregeling afkoppelen (oude regeling) ingezet tot 31-12-2021
- Subsidie verstrekken voor het vergroenen van particulier bezit (Tiny Tuiny bijv.)

- Subsidie verstrekken voor zelfredzaamheid zoals civiel technische maatregelen tegen wateroverlast (schotten, zandzakken etc.)
- Stimuleringsregeling afkoppelen (nieuwe regeling) gaan inzetten vanaf 2022
- Geen van bovenstaande opties
- Weet ik niet
- Andere subsidie verstrekt, namelijk:

Welke van de volgende belastingen of heffingen zijn er toegepast binnen uw gemeente om klimaatadaptatie te bevorderen? (Meerdere antwoorden mogelijk)

- WOZ-belasting verlagen bij een vermindering van het verhard oppervlak
- Rioolheffing verhogen omwille van bekostigen klimaatadaptieve maatregelen (bijv. het versneld scheiden van het riool)
- Rioolheffing differentiatie: verlagen heffing bij een vermindering van het verhard oppervlak
- Rioolheffing differentiatie: verlagen heffing bij afkoppeling
- Geen van bovenstaande opties
- Weet ik niet
- Anders:

Zijn er nog andere economische instrumenten toegepast binnen uw gemeente? (Meerdere antwoorden mogelijk)

- Opkopen van gronden ten behoeve van klimaatadaptieve maatregelen (wadi's, regenwaterbuffers etc.)
- Groene leges: korting op omgevingsvergunning wanneer er klimaatadaptief gebouwd wordt
- Besparen op beheer en onderhoud door ander soort beplanting aan te leggen die tegen extremere weersomstandigheden bestand is. Besparing kan weer uitgegeven worden aan nieuwe beplanting
- Besparen op kosten door eigen groenpersoneel in te zetten ipv het uit te besteden waardoor het mogelijk wordt meer groenprojecten uit te voeren
- Opkopen van gronden die zwaar getroffen worden door klimaatverandering
- Geen van bovenstaande opties
- Weet ik niet
- Anders:

De gemeente heeft klimaatadaptatie in de volgende instrumenten opgenomen

- Omgevingsvisie of andere visie
- Klimaatadaptatie programma / lokale uitvoeringsagenda
- Bestemmingsplannen / omgevingsplan
- Exploitatieplannen of anterieure overeenkomsten
- Groenbeleidsplannen
- Gemeentelijk rioleringsplan / waterprogramma
- Prestatieafspraken met woningcorporatie(s)
- Anders:

Daarvoor zijn de volgende zaken toegepast:

- Regels opgenomen om wateroverlast en droogte tegen te gaan binnen bestemmingsplannen / omgevingsplan (Bijv. verplichten tot waterberging op eigen terrein, afkoppelen, maximum aan verharding etc.)
- Regels opgenomen om hittestress tegen te gaan binnen bestemmingsplannen / omgevingsplan (Bijv. regels over warmte werend en verkoelend inrichten, weerkaatsing glas etc.)

- Hemelwaterverordening toegepast: klimaatadaptatie opgenomen in de regels over de afvoer van grond- en hemelwater. (Bijv. verbod op aankoppelen in geval van nieuw-, aan- en verbouw)
- Eisen en regels stellen aan de inrichting ter bevordering van klimaatadaptatie middels een anterieure overeenkomst of exploitatieplan (Bijv. groenvoorzieningen of het plaatsen van nutsvoorzieningen zoals elektriciteitskasten op hoger gelegen gebieden)
- Klimaatadaptatie opgenomen binnen de prestatieafspraken met de woningcorporatie(s)
- Convenanten gesloten met partijen om samen aan klimaatadaptatie te gaan werken
- Onteigening van gronden ten behoeve van klimaatadaptatieve maatregelen (ruimte voor afvoer van hemelwater, waterretentie gebieden etc.)
- Geen van bovenstaande opties
- Weet ik niet
- Anders;

Appendix E Survey data

Information instruments	Frequency	Percentage
Stresstesten waarmee er overzicht is binnen alle vier de klimaatadaptieve onderwerpen (overstroming, wateroverlast, droogte en hittestress)	23	85,2
Stresstesten met uitwerking van de knelpunten	18	66,7
De stresstesten worden binnen onze gemeente gebruikt bij nieuwe ruimtelijke ontwikkelingen	18	66,7
De voorkeurstabel afkoppelen wordt binnen onze gemeente gebruikt bij nieuwe ruimtelijke ontwikkelingen	16	59,3
Onderzoek naar mogelijke toekomstscenario's betreffende klimaatverandering	12	44,4
Onderzoek naar mogelijke klimaat adaptieve maatregelen binnen de gemeente	21	77,8
Kosten baten analyses van maatregelen	11	40,7
In contact staan met inwoners en informatie ophalen over klimaatadaptatie (ervaringen wateroverlast, hittestress etc.)	18	66,7
Een vorm van klimaateducatie aanbieden op scholen	7	25,9
Educatie van stratenmakers en hoveniers over klimaatadaptieve inrichting	3	11,1
Opgedane kennis binnen de eigen gemeente delen met andere gemeenten	13	48,1

Communication instruments	Frequency	Percentage
Risicodialogen: communicatie met stakeholders over knelpunten die naar voren kwamen tijdens de stresstesten en hoe deze gezamenlijk op te lossen	17	63
Informereren van inwoners, bedrijven, boeren en andere actoren over wateroverlast, droogte, hittestress en overstromingen om bewustzijn te creëren over deze problemen	17	63
Adviseren over welke klimaat adaptieve maatregelen inwoners en bedrijven kunnen implementeren en welke subsidies en mogelijkheden er beschikbaar zijn	16	59,3
Partijen aanmoedigen om af te koppelen (bijv. Waterklaar promoten)	23	85,2
Partijen aanmoedigen om te ontstenen (promotie NK tegelwippen, operatie steenbreek, tegels gratis ophalen etc.)	8	29,6
Partijen aanmoedigen om te vergroenen (samenwerking met tuincentra, korting op beplanting, cursus tuinieren aanbieden)	8	29,6
Klimaatadaptatie opnemen in gemeentelijke social media	13	48,1
Met burgers in contact komen over klimaatadaptatie (markten, bijeenkomsten, infoavonden etc.)	11	40,7

Organization instruments	Frequency	Percentage
Integraal werken: bestuursakkoord of gedeelde visie bereiken binnen de gemeente zodat alle andere domeinen klimaatadaptatie ook zullen opnemen	9	33,3
Integraal werken: een programmamanager aanwijzen om integraal werken te bevorderen binnen alle domeinen (wonen, energietransitie etc.) en klimaatadaptatie hierin meenemen	7	25,9
Klimaat meenemen bij de inkoop voor de gemeente	4	14,8
Integraal werken: gebiedsgericht werken	17	63
Klimaatadaptatie wordt meegenomen tijdens herstructureringen of andere projecten	20	74,1
Klimaatadaptatie wordt op een andere manier integraal meegenomen	9	33,3
Klimaatadaptatie opnemen binnen contracten en aanbestedingen	7	25,9
Op de hoogte blijven over klimaatadaptatie (cursussen volgen, artikelen lezen etc.)	19	70,4
Collega's bewust maken over het thema klimaatadaptatie	21	77,8

Economic instruments	Frequency	Percentage
Investeren in het klimaatadaptief maken van de gemeentelijke panden (gemeentehuis, sportaccommodaties, scholen etc.)	10	37
Investeren in overstromingsmaatregelen (stuwen, opvangbekkens, buffers, wadi's)	17	63
Investeren in het vernieuwen van draaiboeken tijdens calamiteiten en waarschuwingssystemen	10	37
Investeren in groen blauwe schoolpleinen	12	44,4
Investeren in het scheiden van het riool (afvalwater en hemelwater)	22	81,5
Investeren in het afkoppelen van de openbare ruimten	22	81,5
Investeren in het vergroten van de capaciteit van het riool	15	55,6
Investeren in bovenstroomse afremming (beplanting, civiele oplossingen)	9	33,3
Investeren in maatregelen tegen (bos)branden	3	11,1
Investeren in het vergroenen van de openbare ruimten	16	59,3
Investeren in het vergroenen van particuliere ruimten (Ik groen het bijv.)	8	29,6
Investeren in het ontsteden van het publiek bezit (grote parkeerplaatsen groen doorlatende verharding aanleggen bijv.)	7	25,9
Investeren in het verminderen van hittestress door kleurgebruik en materiaalgebruik aan te passen	2	7,4
Investeren in het verminderen van hittestress	4	14,8

Stimuleringsregeling afkoppelen (oude regeling) ingezet tot 31-12-2021	24	88,9
Stimuleringsregeling afkoppelen (nieuwe regeling) gaan inzetten vanaf 2022	21	77,8
Subsidie verstrekken voor groene gevels / daken	5	18,5
Subsidie verstrekken voor het vergroenen van particulier bezit (Tiny Tuiny bijv.)	5	18,5
Rioolheffing verhogen omwille van bekostigen klimaatadaptieve maatregelen (bijv. het versneld scheiden van het riool)	6	22,2
Rioolheffing differentiatie: verlagen heffing bij afkoppeling	1	3,7

Legal instruments: De gemeente heeft klimaatadaptatie in de volgende instrumenten opgenomen	Frequency	Percentage
Omgevingsvisie of andere visie	15	55,6
Klimaatadaptatie programma / lokale uitvoeringsagenda	18	66,7
Bestemmingsplannen / omgevingsplan	10	37
Exploitatieplannen of anterieure overeenkomsten	4	14,8
Groenbeleidsplannen	7	25,9
Gemeentelijk rioleringsplan / waterprogramma	22	81,5
Prestatieafspraken met woningcorporatie(s)	8	29,6
Daarvoor zijn de volgende zaken toegepast:		
Regels opgenomen om wateroverlast en droogte tegen te gaan binnen bestemmingsplannen / omgevingsplan (Bijv. verplichten tot waterberging op eigen terrein, afkoppelen, maximum aan verharding etc.)	17	63
Regels opgenomen om hittestress tegen te gaan binnen bestemmingsplannen / omgevingsplan (Bijv. regels over warmtewerend en verkoelend inrichten, weerkaatsing glas etc.)	3	11,1
Hemelwaterverordening toegepast: klimaatadaptatie opgenomen in de regels over de afvoer van grond- en hemelwater. (Bijv. verbod op aankoppelen in geval van nieuw-, aan- en verbouw)	13	48,1
Eisen en regels stellen aan de inrichting ter bevordering van klimaatadaptatie middels een anterieure overeenkomst of exploitatieplan (Bijv. groenvoorzieningen of het plaatsen van nutsvoorzieningen zoals elektriciteitskasten op hoger gelegen gebieden)	5	18,5
Klimaatadaptatie opgenomen binnen de prestatieafspraken met de woningcorporatie(s)	8	29,6
Convenanten gesloten met partijen om samen aan klimaatadaptatie te gaan werken	1	3,7

Appendix F Interview guides

First round of interviews

Introductie <ul style="list-style-type: none">- Provincie Limburg: verslag rol van de provincie- Master thesis: beleidsarrangement- Opnemen
Beleidsarrangement
<u>Discourse</u> <ul style="list-style-type: none">• Wat houdt klimaatadaptatie volgens u in? Wat is de oorzaak dat de omgeving momenteel nog niet klimaatadaptief is ingericht?• Ervaart u dat klimaatadaptatie een prioriteit is binnen de gemeenten? Waarom wel /niet? Ligt de nadruk binnen gemeenten vooral op wateroverlast? Of ook op hittestress?• Hoe ziet een klimaatadaptieve toekomst er uit binnen uw gemeente?• Wat is de strategie om deze toekomst te bereiken? Welke projecten worden hiervoor uitgevoerd?
<u>Actoren</u> <ul style="list-style-type: none">• Welke actoren spelen een rol binnen klimaatadaptatie?• Hoe zien jullie de eigen rol van de gemeente? Welke middelen zijn daarvoor ingezet?
<u>Hulpmiddelen</u> <ul style="list-style-type: none">• Beschikt de gemeente over voldoende kennis over klimaatadaptatie om het onderwerp op te pakken? (Over toekomstscenario's, knelpunten, maatregelen en hoe het binnen beleid verankerd zou kunnen worden) Mist er nog informatie / kennis binnen klimaatadaptatie? Waar wordt er een tekort ervaren?• Beschikt de gemeente over voldoende financiële middelen om klimaatadaptatie uit te voeren? Welke financiële middelen zijn er ingezet om klimaatadaptatie te bevorderen? (Direct investeren in programma's, subsidies, belasting/heffingen) Missen er nog financiële middelen? Waar wordt er een tekort ervaren?• Beschikt de gemeente over voldoende personeel om klimaatadaptatie en de toekomstige ambities uit te kunnen voeren? Werkt dit door in de instrumentkeuze die wordt gebruikt?
<u>Regulering</u> <ul style="list-style-type: none">• Hoe wordt klimaatadaptatie binnen de gemeente verankerd? Binnen visies, binnen bestemmingsplannen? Welke juridische middelen zijn er ingezet om klimaatadaptatie te regisseren? (Regels opnemen binnen bestemmingsplannen of een grond / hemelwaterverordening etc)• Zijn er regels of wetgeving waar de gemeente tegenaan loopt bij het implementeren van klimaat adaptieve projecten? Kunt u voorbeelden noemen? Of zouden er juist meer regels en wetgeving bij mogen?• Zou klimaatadaptatie in de ruimtelijke ordening moeten worden opgenomen? Hoe wordt dat nu opgenomen? Delft klimaatadaptatie nu het onderspit tegenover andere onderwerpen binnen de ruimtelijke ordening?
Rol provincie Limburg

- Zou water een leidend principe moeten zijn binnen de ruimtelijke ordening? Zouden er regels opgenomen moeten worden betreffende dit thema en wie zou dat dan moeten doen (gemeenten, provincie, rijk)?
- Wat voor rol ziet de gemeente voor de provincie binnen klimaatadaptatie?
 - Zou de provincie moeten faciliteren? Op welke manier? (Water regio's?)
 - Zou de provincie moeten regisseren? Meer verankeren in beleid, opnemen binnen de verordening, convenanten sluiten?
 - Zou de provincie moeten stimuleren? (Subsidie, cofinanciering etc.) Op welke manier en voor welk soort projecten?
 - Zou de provincie moeten verbinden? Er zijn twee Limburgse vormen van verbinding: bestuurlijke klimaatadaptatie tafel, ambtelijke klimaatadaptatie tafel, Ambtelijk Regionaal Overleg Limburg en Bestuurlijke Regionale Overleg Limburg is dat voldoende of zitten daar verbeteringen in?
 - Zou de provincie kennis moeten verspreiden? Wordt die rol enigszins al opgevuld door Platform Klimaatadaptatie Zuid Nederland en de regionale overleggen?

Afsluiting

- Terugkoppeling resultaten

Second round of interviews

Introductie

- Master thesis: beleidsinstrumenten
- Opnemen

Beleidsinstrumenten

- Is er vooraf een beleidsinstrument binnen klimaatadaptatie waarvan u vindt dat deze ontbreekt of niet goed werkt?

Informatie en communicatie instrumenten

- Welke kennis en informatie zijn er ingezet om klimaatadaptatie te bevorderen? Mist er nog informatie binnen klimaatadaptatie? Is dit maatregel specifieke informatie? Kosten baten van maatregelen?
- Welke communicatiemiddelen zijn er ingezet om klimaatadaptatie te bevorderen? (Risicodialogen, adviesgesprekken afkoppelen, mensen aanzetten tot ontstenen) Zou de communicatie nog verbeterd kunnen worden? Op welke manier? Waterklaar? Mist er nog een communicatie instrument binnen klimaatadaptatie?

Organisatorische instrumenten

- Hoe wordt klimaatadaptatie georganiseerd binnen de gemeente? Zou het integraal werken binnen de gemeente kunnen verbeteren? Nemen andere sectoren klimaatadaptatie mee? (Ook in dagelijkse werkzaamheden?)
- Wordt er een tekort aan uren ervaren voor klimaatadaptatie? Hoe zou dit kunnen worden opgelost?

Economische instrumenten

- Is er binnen de gemeenten en regio een tekort aan financiële middelen voor projecten binnen klimaatadaptatie? Welke / wat voor soort projecten?
- In welke klimaat adaptieve projecten investeert de gemeente?
- Wordt er binnen de gemeente gewerkt met subsidies voor klimaatadaptatie? Worden subsidies gebruikt van andere actoren? Hoe worden die ervaren? Mist er nog een subsidie?
- Wordt er binnen de gemeente gewerkt met een rioolheffing systeem of ander belasting systeem? Mist dit nog in de instrumenten?
- Zijn er economische instrumenten zoals subsidies, heffingssystemen of investeringen waar verbetering in mogelijk zijn?
- Mist er nog een specifiek economisch instrument?

Juridische instrumenten

- Hoe wordt klimaatadaptatie momenteel gereguleerd?
- Zouden er regels opgenomen moeten worden over klimaatadaptatie?
- Hoe zou klimaatadaptatie juridisch opgenomen moeten worden?
- Op welk schaalniveau zou dit moeten worden opgenomen?

Afsluiting

- Zijn er nog instrumenten niet benoemd die wel worden toegepast binnen de gemeente? Welke?
- Terugkoppeling resultaten

Extra questions regional coordinators

Stress testen

Op welke manier zijn de stress testen uitgevoerd (binnen alle vier de onderwerpen)? Wat voor knelpunten volgen er uit de stresstesten en hoe zijn deze verder vertaald? Hoe worden resultaten uit de stresstest vertaald naar acties?

Wat doen gemeenten met de resultaten uit de stresstest? Vertalen ze deze ook naar concrete acties, en zo ja: welke? Wordt er hierna geprioriteerd? Worden de stresstesten gebruikt in ruimtelijke plannen?

Risico dialogen

Zijn er in deze regio al risicodialogen gehouden? Op welke manier is hier uitvoering aan gegeven? Met welke actoren? Gingen deze risicodialogen over een bepaalde problematiek of waren ze globaal? Zijn er actoren gemist tijdens de risicodialogen die in de toekomst nog betrokken zouden moeten worden? Worden de risicodialogen in de praktijk ervaren als een effectief instrument?

Implementatie agenda's

Op welk punt zit deze regio in het adaptatieproces? Met welke projecten gaat de regio aan de slag in de uitvoeringsagenda? Zit hier nog verbetering in?

Is de impulsregeling al aangevraagd? Voor welke projecten? Ervaart de regio obstakels binnen de impulsregeling?

Introductie <ul style="list-style-type: none">- Opnemen
Beleidsarrangement windows of opportunity
<u>Discourse</u> <ul style="list-style-type: none">• Wat houdt klimaatadaptatie volgens u in? Wat is de oorzaak dat de omgeving momenteel nog niet klimaatadaptief is ingericht?• Heeft de overstroming van 2021 geleid tot een hoger urgentie niveau binnen de provincie? Wordt er meer prioriteit aan klimaatadaptatie gegeven? Zijn er veranderingen in het discours merkbaar (ander perspectief / denkwijze over klimaatadaptatie)?• Wat is de strategie om een volgende overstroming te voorkomen? Welke projecten worden hiervoor uitgevoerd?
<u>Actoren</u> <ul style="list-style-type: none">• Welke actoren spelen een rol bij het werken naar een klimaat adaptieve omgeving? Hebben andere actoren zich aangesloten na de overstroming?• Hoe zien jullie de eigen rol van de provincie binnen klimaatadaptatie? Welke middelen zijn daarvoor ingezet?
<u>Hulpmiddelen</u> <ul style="list-style-type: none">• Beschikt de provincie na de overstroming over voldoende kennis over klimaatadaptatie om het onderwerp versneld uit te voeren? (Over toekomstscenario's, knelpunten, maatregelen en hoe het binnen beleid verankerd zou kunnen worden) Mist er nog informatie / kennis binnen klimaatadaptatie? Waar wordt er een tekort ervaren?• Beschikt de provincie na de overstroming over voldoende financiële middelen om klimaatadaptatie versneld uit te voeren? Welke financiële middelen zijn er ingezet om klimaatadaptatie te bevorderen? Propositie? Missen er nog financiële middelen?• Beschikt de provincie na de overstroming over voldoende personeel om klimaatadaptatie en de toekomstige ambities uit te kunnen voeren? Hoe zou dit opgelost kunnen worden?
<u>Regulering</u> <ul style="list-style-type: none">• Hoe wordt klimaatadaptatie binnen de provincie verankerd? Welke juridische middelen zijn er ingezet om klimaatadaptatie te regisseren?• Zou klimaatadaptatie meer gereguleerd moeten worden? Op welke manier?• Heeft de overstroming een effect gehad op de regulering van klimaatadaptatie?• Zou klimaatadaptatie in de ruimtelijke ordening moeten worden opgenomen? Hoe wordt dat nu opgenomen? Delft klimaatadaptatie nu het onderspit tegenover andere onderwerpen binnen de ruimtelijke ordening?
Beleidsinstrumenten <ul style="list-style-type: none">• Zijn er beleidsinstrumenten die momenteel minder goed functioneren?• Zijn er nog niet benoemde beleidsinstrumenten die gemist worden om klimaatadaptatie effectief uit te kunnen voeren?
Afsluiting

- Terugkoppeling resultaten

Interviewguide water authority Limburg

Introductie

- Master thesis: beleidsarrangement en beleidsinstrumenten
- Opnemen

Beleidsarrangement

Discourse

- Wat houdt klimaatadaptatie volgens u in? Wat is de oorzaak dat de omgeving momenteel nog niet klimaatadaptief is ingericht?
- Ervaart u dat klimaatadaptatie een prioriteit is binnen het Waterschap? Waarom wel / niet?
- Hoe ziet een klimaat adaptieve toekomst er uit binnen het Waterschap?
- Wat is de strategie om deze toekomst te bereiken? Welke projecten worden hiervoor uitgevoerd?

Actoren

- Welke actoren spelen een rol binnen klimaatadaptatie?
- Wat is de rol van het Waterschap binnen klimaatadaptatie? Welke middelen zijn daarvoor ingezet? Mist hier nog een rol van de provincie?

Hulpmiddelen

- Beschikt het Waterschap over voldoende kennis over klimaatadaptatie om het onderwerp op te pakken binnen de gemeente? Over toekomstscenario's, knelpunten, maatregelen en hoe het binnen beleid verankerd zou kunnen worden. Mist er nog informatie / kennis binnen klimaatadaptatie? Waar wordt er een tekort ervaren?
- Communiqueert het Waterschap ook over klimaatadaptatie? Op welke manier? Zou hier nog verbetering in mogelijk zijn?
- Beschikt het Waterschap over voldoende financiële middelen om klimaatadaptatie uit te voeren? Welke financiële middelen hebben jullie ingezet om klimaatadaptatie te bevorderen? (Direct investeren in programma's, subsidies, belasting/heffingen). Missen er nog financiële middelen?
- Beschikt het Waterschap over voldoende personeel om klimaatadaptatie en de toekomstige ambities uit te kunnen voeren? Werkt dit door in de instrumentkeuze die jullie gebruiken? Is de organisatie van klimaatadaptatie een obstakel?

Regulering

- Hoe wordt klimaatadaptatie verankerd binnen het Waterschap? Welke juridische middelen zijn er binnen het Waterschap al ingezet om klimaatadaptatie te regisseren? (Regels opnemen binnen bestemmingsplannen of een grond / hemelwaterverordening etc) Missen hier nog bepaalde juridische instrumenten? Welke?
- Zijn er regels of wetgeving waar het Waterschap tegenaan loopt bij het implementeren van klimaatadaptieve projecten? Of zouden er juist nog wat meer regels en wetgeving bij mogen?

- Zou klimaatadaptatie in de ruimtelijke ordening moeten worden opgenomen? Hoe wordt dat nu opgenomen? Delft klimaatadaptatie nu het onderspit tegenover andere onderwerpen binnen de ruimtelijke ordening?

Beleidsinstrumenten

- Zijn er beleidsinstrumenten die momenteel minder goed functioneren?
- Zijn er nog niet benoemde beleidsinstrumenten die gemist worden om klimaatadaptatie effectief uit te kunnen voeren?

Afsluiting

- Terugkoppeling resultaten

Appendix G Code scheme

Deductive coding

Category	Codes
Actors	<ul style="list-style-type: none"> - AKAL and BKAL - Municipalities (incl. role) - Province (incl. role) - Water Authority (incl. role) - Regions climate adaptation - Platform klimaatadaptatie Zuid-Nederland - Role Province Noord-Brabant and Gelderland - Companies - Project developers - Social housing corporations - Other coalitions (drought, HWBP etc.) - Other stakeholders
Discourse	<ul style="list-style-type: none"> - Definition climate adaptation - Drought - Flooding - Heat stress - Water nuisance - Ontological / cause climate adaptation - Normative / ideal situation - Strategy (area guided approach, rainwater sewage, regional projects etc) - Strategy, regional programs - Implementation programs
Resources	<ul style="list-style-type: none"> - Financial capacity - High investment costs bottlenecks and sewage - Human capacity - Knowledge lacuna heat stress and green - Knowledge sharing is limited - Lack of investment / human capacity of Province - Implementing power other provinces
Rules of the game	<ul style="list-style-type: none"> - Climate adaptation should not be regulated - Need for frames and regulation - Political culture - Procedure (stress test - risk dialogue - implementation program)
Information and communication instruments	<ul style="list-style-type: none"> - Communication with inhabitants - Municipal information / communication actions - More communication necessary - Lacking communication between governments

	<ul style="list-style-type: none"> - Measure related research - Risk dialogues - Stress tests - Water related research - Waterinlimburg.nl - Waterklaar
Organizational instruments	<ul style="list-style-type: none"> - Administrative agreement - Linking opportunities - Multi-disciplinary team - Need for policy civil servant - Organization of climate adaptation - Research linking opportunities - Sustainability team - Water civil servant - Working integrally - Climate adaptation is a linking opportunity
Economic instruments	<ul style="list-style-type: none"> - Agricultural subsidies - Contribution arrangement - DHZ - Disconnection of the sewage subsidy - DPRA Impulse arrangement - Invest during restructurings - Investing in programs (Room for the Brook, Water in Balance, Area guided approach) - One million tree plan - Pop-3 - Subsidies - Sewage tax differentiation - Tile tax - Water Authority Tax
Legal instruments	<ul style="list-style-type: none"> - Climate adaptive building covenant - Disconnection of the sewage table - Environmental vision - Flood norm - Irrigation covenant - Keur - Land consolidation service - Motivational climate adaptive paragraph - Municipal norm mm water storage (policy) - Ordinance - Performance agreements - Rules about green and heat stress - Sewage Plan - Water Authority norm mm water storage - Water test Water Authority

Inductive coding

Category	Codes
Actors	<ul style="list-style-type: none"> - Multitude of meetings - Role Province insufficient
Discourse	<ul style="list-style-type: none"> - Water discourse (drought, flooding, water nuisance) - Fragmentation - Climate adaptation is a continuous process - Uncertainty - Priorities between and within the climate adaptive topics and other interests
Resources	<ul style="list-style-type: none"> - Compartmentalization of budgets - Physical features
Rules of the game	NA
Information and communication instruments	<ul style="list-style-type: none"> - Awareness - Missing a decision making structure
Organizational instruments	<ul style="list-style-type: none"> - Decompartmentalization of budgets necessary - Cooperation between governments - Lessons other Provinces
Economic instruments	<ul style="list-style-type: none"> - Administration afterwards - Lack of green incentives and budgets - Priority when funds / subsidy is available - Process costs - Room for flexibility (including green etc.)
Legal instruments	<ul style="list-style-type: none"> - Level of implementing rules - Water as a guiding principle