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RESEARCH ARTICLE



The effectiveness of communicative tools in addressing barriers to municipal climate change adaptation: lessons from the Netherlands

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ABSTRACT

Little research has been done on the effectiveness of communicative tools for climate change adaptation. Filling this knowledge gap is relevant, as many national governments rely on communicative tools to raise the awareness and understanding of climate impacts, and to stimulate adaptation action by local governments. To address this knowledge gap, this study focuses on the effectiveness of communicative tools in addressing key municipal barriers to climate change adaptation, by conducting a large N-size empirical study in the Netherlands. This study explores the effectiveness of these tools in theory, by checking whether their goals match the perceived barriers to municipal climate change adaptation, and the effectiveness in practice by analysing whether they are used and perceived as useful. Document analyses have clarified the assumptions underlying the tools. By conducting semi-structured interviews with 84 municipalities the key barriers to climate change adaptation and the use and usefulness of the tools in practice were analysed. The research revealed that the key barriers experienced by municipalities are a lack of urgency, a lack of knowledge of risks and measures, and limited capacity, the first being the primary one. Communicative tools, while being effective in theory, are not sufficiently effective in practice in addressing the key barriers. Municipalities that are not experiencing a sense of urgency to take on adaptation planning are not likely to be activated by the tools. Advanced municipalities need more sophisticated tools. This article concludes with some suggestions to improve the effectiveness of communicative tools.

Key policy insights

- Although effective in theory in addressing key barriers to municipal adaptation planning, the effectiveness in practice of communicative tools is limited.
- To increase their effectiveness in practice, municipalities' awareness of the existence of the communicative tools needs to be raised.
- Advanced municipalities need more sophisticated tools that are context-specific and address a wide range of climate risks.
- The effectiveness of communicative tools can be improved by embedding them in a wider mix of policy instruments.

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1. Introduction

Communicative tools are a potentially effective means to make climate science accessible and usable. It is often stated in the climate change adaptation literature that policy makers have difficulty in accessing and using climate science to inform adaptation planning and action (Archie, Dilling, Milford, & Pampel, 2014; Porter, Demeritt, & Dessai, 2015;

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Preston, Mustelin, & Maloney, 2015), a phenomenon that has been referred to as the 'climate information usability gap' (Lemos, Kirchhoff, & Ramprasad, 2012). Studies on the effectiveness of policy tools for climate change adaptation are scarce, and those studies tend to be conceptual rather than empirical in nature (Henstra, 2016; Mees et al., 2014). Moreover, so far little research has been done on the effectiveness of communicative tools for climate change adaptation (Moser, 2010). Research on the effectiveness of communicative tools is important, as an increasing number of national governments and supra-national bodies appear to rely on communicative tools to raise the awareness and understanding of climate impacts and of suitable solutions, and to stimulate climate change adaptation action by local/regional governments and the public (Biesbroek, Swart, Carter, & Rey, 2010; Moser, 2010).

This study focuses on the effectiveness of communicative tools in the Netherlands, by conducting a large N-size empirical study into the communicative tools for addressing key municipal barriers to climate change adaptation. In the Netherlands, weather extremes, and in particular, heavy rainfall events and heatwaves, have been increasing in occurrence and intensity as a result of climate change (Rioned, 2013; WMO, 2013; Wuijts, Vros, Schets, & Braks, 2014). In the summers of 2015 and 2016 there were many cloud-bursts, causing incidents of surface water flooding on streets, basement flooding and damage to crop production in municipalities across the Netherlands (KNMI, 2016; NRC, 2016). Heat-related deaths as a result of heatwaves have already occurred, and are expected to increase in the next decades (Forsberg et al., 2012). Adaptation to these extreme events is inherently a local issue, as their impacts are localized. Municipalities have a responsibility for the reduction and prevention of surface water flooding on public ground, and for safeguarding the health of their citizens. Consequently, several frontrunner municipalities are proactively developing climate change adaptation plans and actions. However, most municipalities are lagging behind in adaptation planning and action in the Netherlands (Den Exter, Lenhart, & Kern, 2015; Hoppe, Van den Berg, & Coenen, 2014; Runhaar, Mees, Wardekker, Van der Sluijs, & Driessen, 2012) and elsewhere (Bulkeley, 2013; Carter et al., 2015; Measham et al., 2011).

The Dutch national government acknowledges that it is important for municipalities to address adaptation to climate change. Adaptation often requires the implementation of measures in the built environment, and in the Netherlands as in most other countries, local authorities such as municipalities are responsible for physical planning (Amundsen, Berglund, & Westskog, 2010; Urwin & Jordan, 2008). Contrary to countries such as Denmark in which the central government obliges municipalities to write an adaptation plan for their jurisdictions (Concito, 2016), the Dutch national government uses soft regulation to raise the adaptation planning capacity of municipalities by distributing and sharing knowledge. For this purpose, the Dutch government has developed the *Spatial Adaptation Knowledge Portal*, an online platform. Through this portal, communicative tools are distributed that provide municipalities with information on impacts of climate change, strategies and implementation options. The portal is intended to support municipalities and to help them to address persistent barriers, such as a lack of knowledge, that are currently blocking their adaptation planning and implementation.

So far, the climate adaptation literature has paid much attention to the identification and classification of barriers. Based on an extensive literature review, Biesbroek, Termeer, Klostermann, and Kabat (2014) found that few studies go beyond general explorations and categorizations, and little effort has been done to analyse how these barriers can be overcome using communicative tools. This study aims to build on this literature by analysing whether the web-based communicative tools provided by the Dutch government are effective in addressing the key barriers to the adaptation planning of Dutch municipalities.

Section 2 elaborates on the framework we have developed for analysing the effectiveness of the communicative tools. Section 3 clarifies our research methods. Section 4 discusses the results in terms of the theoretical effectiveness of the communicative tools used by the national government to promote adaptation planning by Dutch municipalities. Section 5 discusses the results in terms of practical effectiveness. The article ends with a discussion and conclusion.

2. The effectiveness of communicative tools in addressing key barriers

2.1. Communicative tools

Tools are policy instruments that governments use to steer the behaviour of other actors to reach a certain policy goal (Schneider & Ingram, 1990). They are often referred to as the 'tools of government' (Hood, 1983). This study

addresses web-based communicative tools, which the national government uses to steer the behaviour of Dutch municipalities through information provision, without altering incentives or authority systems (Weiss & Tschirhart, 1994). In various taxonomies of policy instruments, communicative tools have been classified as ‘communicative instruments’ (e.g. Brukas & Sallnäs, 2012; Glasbergen, 1992; Gunningham & Sinclair, 2002), as ‘capacity tools’ (Schneider & Ingram, 1990) as ‘nodality instruments’ (Hood, 1983; Howlett, 2009) and as ‘sermons’ (as opposed to ‘sticks’ and ‘carrots’ cf. Vedung, Bemelmans-Videc, & Rist, 1998). They are information-based instruments meant for information dissemination, knowledge generation and knowledge mobilization with the aim to inform and support adaptation planning (Henstra, 2016). The tools are ‘soft’ in the sense that they are voluntary and not meant to coerce, so there is less political risk. Moreover, the financial and human resource intensity they require is low (Henstra, 2016).

2.2. Effectiveness

To assess whether the communicative tools, employed by the national government, are effective in addressing the key barriers to adaptation planning and action faced by Dutch municipalities, two perspectives are used in this article: effectiveness in theory and effectiveness in practice.

Following Kautto and Similä (2005), effectiveness *in theory* translates into analysing the extent to which the objectives of a policy instrument cover the key problems. Hence, effectiveness is defined here as the extent to which the goals of the communicative tools *in theory* are compatible with the key barriers perceived by Dutch municipalities. This means that theoretically speaking the goals of the tools need to reflect the decision-making problems of the users in order for the tools to be effective (Rammer et al., 2013).

Biesbroek et al. (2014) describe barriers as subjective interpretations of factors that negatively influence the adaptation process but are manageable and can be overcome. Moser and Ekstrom (2010, p. 22027) define barriers as ‘impediments that can stop, delay, or divert the adaptation process’. For this research we adopt the following definition: ‘barriers are the perceived impediments that can prevent, stop, delay, or divert adaptation planning and action’. In this definition ‘perceived’ refers to the subjective interpretations by municipalities.

Because barriers are often considered place- and context-specific it makes sense to focus on barriers identified in Dutch research. We distinguish two stages of barriers, based on Runhaar et al. (2012): barriers to problem recognition and to taking concrete adaptation measures. This distinction between two stages is relevant and therefore used in this study: it allows a better analysis of the stage at which certain communicative tools are effective or not. For example, it is assumed that tools that provide information on potential measures are more effective for municipalities that want to take concrete adaptation measures.

Effectiveness of the communicative tools *in practice* is analysed by studying the actual use and perceived usefulness of the tools by Dutch municipalities. It is possible that tools address the key barriers in theory, but are still ineffective if municipalities do not know about their existence, do not actually use them or find them useless. Ideally, communicative tools should be effective both in theory and in practice, which means that there is a compatibility between their goals and the perceived key barriers, and that the municipalities are aware of their existence and use them. We consider effectiveness in theory to be a precondition for effectiveness in practice: if the tools are not compatible with the key perceived barriers, they will not be used or considered useful by municipalities. We realize that we measure effectiveness at outcome level (municipal adaptation plans and actions). Assessing the impacts (changes in the characteristics of urban water systems or urban land use that result from those plans) is beyond the scope of our study.

To summarize, in this article we explore the effectiveness of communicative tools by assessing whether they are based on sound assumptions concerning barriers that municipalities face on the one hand, and by assessing their use and perceived usefulness on the other hand.

3. Methods

3.1. The Dutch case study

The online platform *Spatial Adaptation Knowledge Portal* (SAKP) (<http://www.ruimtelijkeadaptatie.nl>) is a spin-off of the Knowledge for Climate Program and the Delta Program. As a follow-up to these two programmes, the

Table 1. SAKP tools overview.

Tools	Intended goals
Tools for risk assessment	
Stress test guide	Provides information for conducting a stress test
Climate adaptation atlas	Visualizes the local effects of climate change on a map
Deltaportal	Supplies information about the Delta Model and instruments
List with examples of calamities	Provides examples of potential local risks
Tools for opportunity assessment	
Green-blue grids	Provides information on risks and examples of adaptation measures
Teeb city	Provides insight into value creation by adding green and blue to cities, cost-benefits estimates
Tools for estimating objectives and challenges	
Infrastructure Strategy Appraiser ('Omgevingswijzer')	Visualizes the sustainability of projects
Tools for developing strategies	
Guiding model	Provides adaptation guiding principles for 11 types of land use
Design workshops	Provides a manual for promoting collaboration for a climate proof city
Tools for policy assurance	
Mainstreaming guide	Integrates and connects adaptation with other policy issues
Tools for implementation	
Mainstreaming guide	Integrates and connects adaptation with other policy issues
Green-blue grids	Provides information on risks and examples of adaptation measures
Showcases	Provides an overview of experiences with spatial adaptation on a national map
App to climate proof your home and garden ('Huisje boompje beter')	Provides information and examples on how to create a climate proof house & garden

Climate Resilient City Manifesto was initiated. A total of 60 parties, consisting of provinces, private parties and fifteen municipalities, were involved in developing this manifesto, and together they formulated 30 actions that are aimed at making the Netherlands more climate resilient, of which the SAKP was one of the most highly prioritized actions (MKBS, 2013). The overall intent of the SAKP is to facilitate and stimulate a wide variety of actors to work on adaptation planning, and particularly regional and local authorities such as provinces, municipalities and water boards. The SAKP tools are divided into six different categories, each corresponding to a different objective in the adaptation process (e.g. risk assessment or implementation). Table 1 provides an overview of the 13 different tools under these 6 categories/objectives and gives a brief description of each tool. During our research period, these tools were freely available without charge.

3.2. Effectiveness in theory

Effectiveness in theory, i.e. the theoretical match between the goals of the communicative tools and the perceived barriers, was assessed in two steps. In the first step, the policy theory behind the tools was reconstructed. As defined by Hoogerwerf (1990, p. 285), a policy theory is 'the total of causal and other assumptions underlying a policy'. For this study, the relationship between the intended goals of the communicative tools and the causes of the policy problem (i.e. the barriers to municipal climate adaptation) were analysed. The intended goals of the different categories of communicative tools were assessed through document analysis. To validate the reconstructed assumptions, a semi-structured expert interview was conducted with the policy designer (Leeuw, 2003), in this case the director of Climate Adaptation Services, the organization responsible for the establishment and development of the portal. In the second step, we analysed whether the intended goals of the tools are compatible with the key barriers as perceived by Dutch municipalities.

These key perceived barriers were derived from semi-structured telephone interviews conducted between February and June 2015 among 146 municipalities that are members of the Dutch Climate Alliance (DCA). The DCA contact persons in the municipalities were approached and interviewed, unless they put forward a colleague who was more knowledgeable on the topic of climate adaptation. The 84 participating municipalities (58% response rate) form a reasonably representative sample of the Dutch municipalities in terms of size and geographical location (see Figure 1). Nevertheless, our sample may be biased in terms of climate awareness as it can be argued that DCA members are more aware of climate risks than average municipalities. Our results, therefore, may be positively influenced in terms of the effectiveness in theory (use and usefulness).

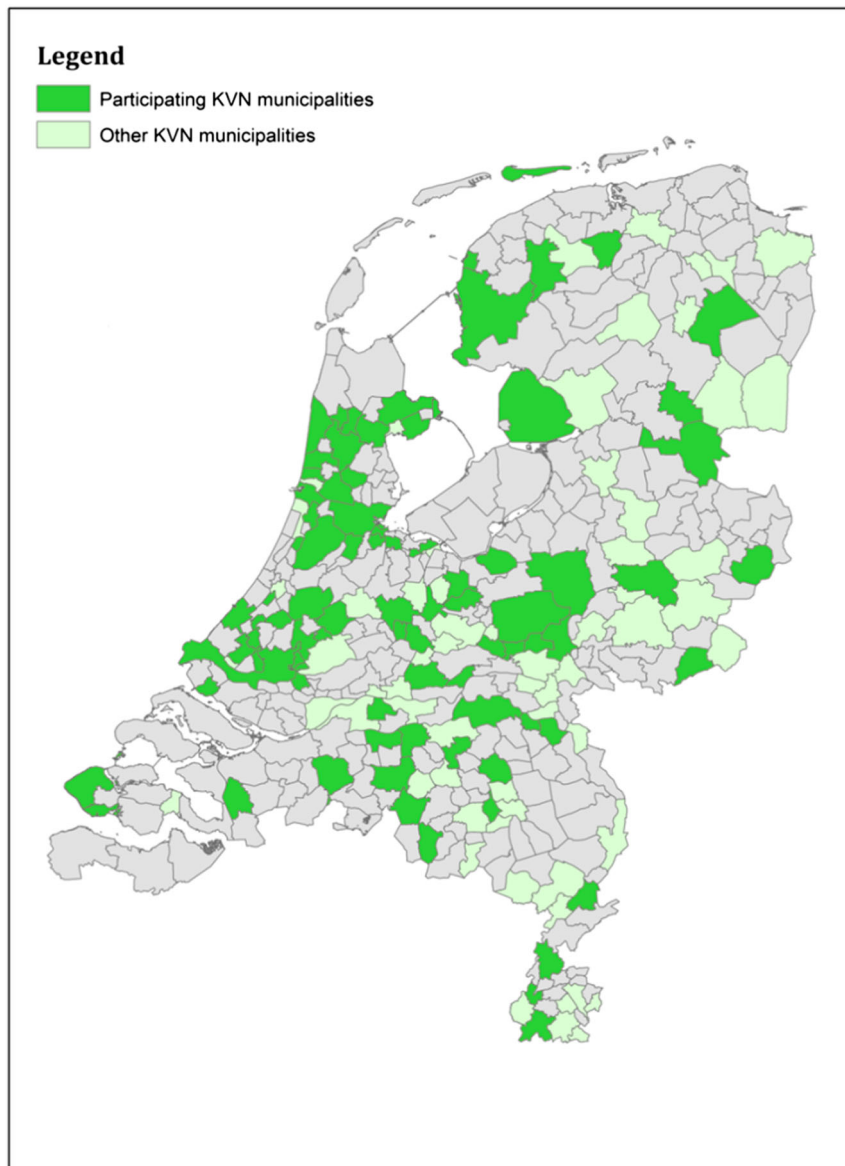


Figure 1. Overview of the sample population of municipalities.

However, it should be noted that, at the time of data collection, climate adaptation was not yet a part of the DCA programme. This means that, initially, the municipalities in this research were affiliated with the DCA, not because of climate adaptation activities but because of mitigation activities. The main reason for having selected DCA municipalities is their accessibility, thus increasing the response rate. The 84 municipalities were addressed using a semi-structured questionnaire (see [Appendix](#)) which allowed answers from different researchers to be compared, and for easy coding. The key barriers were identified through a combination of frequency (which ones are most commonly mentioned) and of significance (which one is mentioned as the most important barrier).

3.3. Effectiveness in practice

For the measurement of effectiveness in practice, i.e. the use and perceived usefulness of the different tools by the municipalities, the telephone interviews among the municipalities again served as the source of data. Each

Table 2. Advancement of adaptation planning of municipalities.

Municipalities	Level of advancement		
	Non-adapters	Less advanced	Advanced
Awareness of risks	No	Yes	Yes
Taking adaptation measures	No	Yes, ad hoc	Yes
Development of policies	No	No, ad hoc addressing hazards	Yes, mainstreaming/standalone policies

municipal representative was asked whether they were familiar with the knowledge portal and its tools; whether they used the tools; and whether the tools were useful, and for what purpose. The interview transcriptions were labelled and an inductively developed category scheme based on those transcriptions (Basit, 2010; LeCompte, 2010) served as the basis for an excel file in which all relevant data was assembled and reduced to the essence, categorized and analysed. Finally, data were compared and patterns identified. This has resulted in an identification of the key barriers, and of the use and usefulness of the tools.

In a next step, municipalities were classified into three categories according to their level of advancement in adaptation planning. This classification allowed for a more in-depth analysis of the practical effectiveness of the tools among our sample: it is assumed that less advanced municipalities require different categories of communicative tools to advanced municipalities.

Table 2 shows the criteria we have used. The main difference between advanced and less-advanced municipalities is that advanced municipalities have already integrated adaptation into their policies, enabling them to proactively take on climate risks. This approach is considered to be more advanced for two reasons. First, since other competing interests and everyday work often get priority, it is beneficial to embed adaptation in municipal planning frameworks to enable local adaptation (Measham et al., 2011). Second, policy development helps to clarify responsibilities, targets and tasks, which in turn enables adaptation action (Mees, 2017).

4. Results

4.1. High effectiveness in theory

4.1.1. The policy theory behind the communicative tools

Figure 2 shows the theory behind the tools as assumed by their developers. It shows the ultimate goal of the tools (take on adaptation planning), how this goal links to the key problem (municipalities are not prepared for climate change impacts) and its underlying causes (expressed in the form of barriers: lack of urgency, limited knowledge of risks, lack of priority, lack of knowledge on adaptation measures, limited capacity and governance difficulties in mainstreaming measures). The tools have sub-goals that address these underlying causes/barriers. For instance, tools for assessing and mapping risks are meant to create a sense of urgency and willingness, and to lower the threshold to start working on adaptation planning. These sub-goals address most of the underlying causes. The SAKP was developed as a passive tool, by bundling all the available knowledge in one place and by making it usable. The developer of the SAKP expected limited capacity to be the main barrier for municipalities. 'The SAKP addresses this limited capacity because the tools make it easier to acquire information and knowledge'. Furthermore, many of the tools can be used free of charge which is also expected to alleviate the capacity barrier.

4.1.2. Perceived key barriers to municipal adaptation

Table 3 shows that the four most commonly perceived barriers to municipal adaptation are a lack of urgency, a lack of knowledge of the risks, limited capacity and a lack of knowledge of the measures. More than half of the municipalities consider a lack of urgency to be the key barrier, while a fifth of all municipalities consider a lack of knowledge, the second most significant barrier, to be the primary one. Table 3 also makes clear that perceptions of the barriers differ slightly between non-adapters (see Table 2), less advanced and advanced municipalities. In particular, 75% of non-adapters perceive a lack of urgency to be a very important barrier, whereas with advanced municipalities this is (only) 31%. The key barriers concern the phase of problem recognition. However, as 'the problem' – many municipalities are not sufficiently prepared for climate change

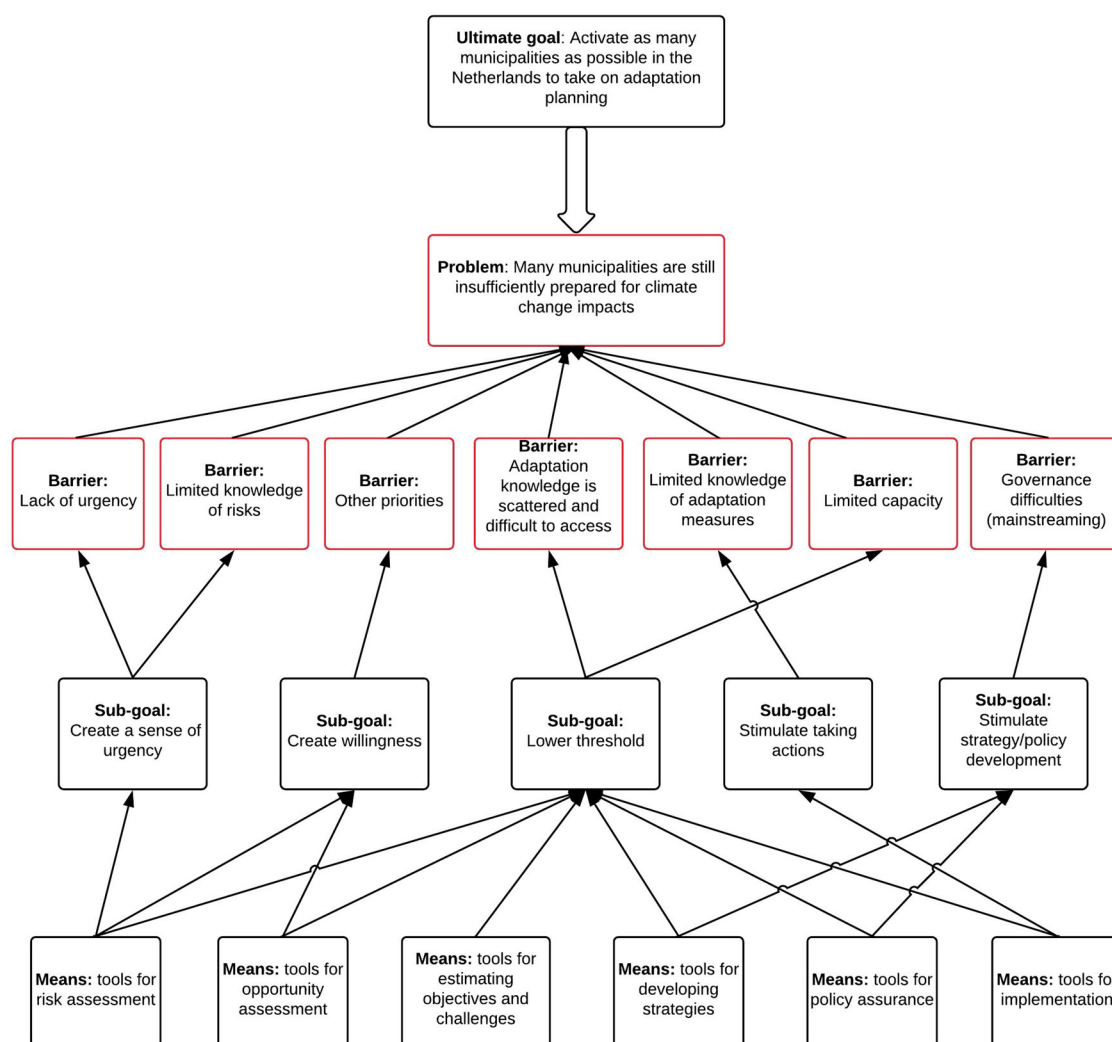


Figure 2. The policy theory behind the Dutch communicative tools.

Table 3. Key barriers as perceived by the municipalities.

Key perceived barriers	Municipalities			
	All	Non-adapters	Less advanced	Advanced
To problem recognition:				
Lack of urgency	50% (42)	75% (12)	58% (19)	31% (11)
Lack of knowledge of risks	17% (14)	12.5% (2)	27% (9)	9% (3)
To taking measures:				
Limited capacity	15% (13)	12.5% (2)	9% (3)	23% (8)
Lack of knowledge of measures	4% (3)	0%	0%	14% (5)
Other barriers	7% (6)	0%	3% (1)	9% (3)
None	7% (6)	0%	3% (1)	14% (5)
Total	100% (84)	100% (16)	100 (33)	100% (35)

impacts – was often not yet experienced in practice at the time of the research, municipalities regarded a lack of urgency to be the most prominent barrier, primarily because of little experience with calamities and limited knowledge of local risks and vulnerabilities. This is likely to change in the near future, given the rise of flooding incidents from heavy rainfall. A key barrier for taking adaptation measures is limited capacity/lack of resources.

However, in addition to being a key barrier to taking adaptation measures, this barrier also prevents municipalities from investing in local risk and vulnerability assessments in the problem recognition phase. Capacity issues are experienced by municipalities in all stages of adaptation planning. Limited capacity is thus considered to be both a barrier to problem recognition and to taking adaptation measures.

4.1.3. Match between policy theory and perceived barriers

By matching the policy theory of the tools, as portrayed in [Figure 2](#), with the perceived municipal barriers as shown in [Table 3](#), it can be concluded that the communicative tools of the Dutch government are effective in theory, because the goals of the tools are compatible with the main barriers as perceived by the municipalities. This is illustrated in [Figure 3](#), which shows that the four key perceived barriers/underlying causes (indicated by bold boxes) – i.e. a lack of urgency, a lack of knowledge of risks, a lack of knowledge of adaptation measures and limited capacity – are all addressed by the communicative tools (the three other barriers that are addressed with the tools, indicated with regular boxes in [Figure 3](#), are perceived as less key, because they were mentioned by a limited number of municipalities and/or were perceived as less important). For instance, the App ‘Huisje, boompje, beter’ is ‘a platform providing concrete measures that municipal authorities can use to motivate, encourage, inspire and activate residents to climate-proof their houses and gardens. The App can be geared to each municipality’s local wishes and individual identity’ (https://ruimtelijkeadaptatie.nl/vaste-onderdelen/zoeken/?zoeken_term=huisje%2C+boompje). Thus, it stimulates municipalities to take action and to exchange knowledge with residents. This prepares the community to deal with climate change impacts.

4.2. Insufficient effectiveness in practice

4.2.1. Awareness and use

[Figure 4](#) gives an overview of the awareness and use of the SAKP tools among municipalities. Overall, only 51% (43) are aware of the availability of the communicative tools, whereas only 25% (23) of all 84 municipalities have made actual use of the communicative tools. In other words, 75% of DCA municipalities are not being encouraged by the tools. Even among the 43 ‘aware’ municipalities (51% of 84) only slightly more than half (23) actually use the tools. Awareness and use of the tools increases with the level of advancement among municipalities, as can be clearly seen in [Figure 3](#). Advanced municipalities have most experience with the tools, as 43% have made use of them. Among those municipalities that use the tools, (23) 52% are located close to a large body of water (making them more vulnerable to climate risks and hence with a higher need for adaptation planning and action), which is slightly higher than the total population (35%); 65% belong to the 70 largest municipalities in the Netherlands; and 74% have an adaptation policy, which is much higher than the total population (42%). In short, awareness and use of the tools is rather moderate, and the ‘aware users’ are relatively large and advanced municipalities.

4.2.2. Perceived usefulness

According to the municipalities that use the tools ($n = 23$) the risk assessment tools are the most useful. They mention that these tools, by exploring the general risks and vulnerabilities to climate change, are mainly useful for creating awareness and political support for climate change adaptation. As the representative of the city of Rotterdam expressed:

They are mainly useful for creating awareness in a broad sense. That is why we think the knowledge portal is very suitable for the bulk of municipalities¹

The perceived usefulness of the risk assessment tools diminishes as municipalities advance in their adaptation planning. A quote from the representative of the city of The Hague, an advanced municipality, illustrates this:

The maps are not always useful because they are not specific enough. It is essential that the maps can be correctly interpreted and that they can be put into perspective.

According to more advanced municipalities the tools for policy implementation are the least developed category, whereas they are the most needed. As the representative of the city of Breda clarified:

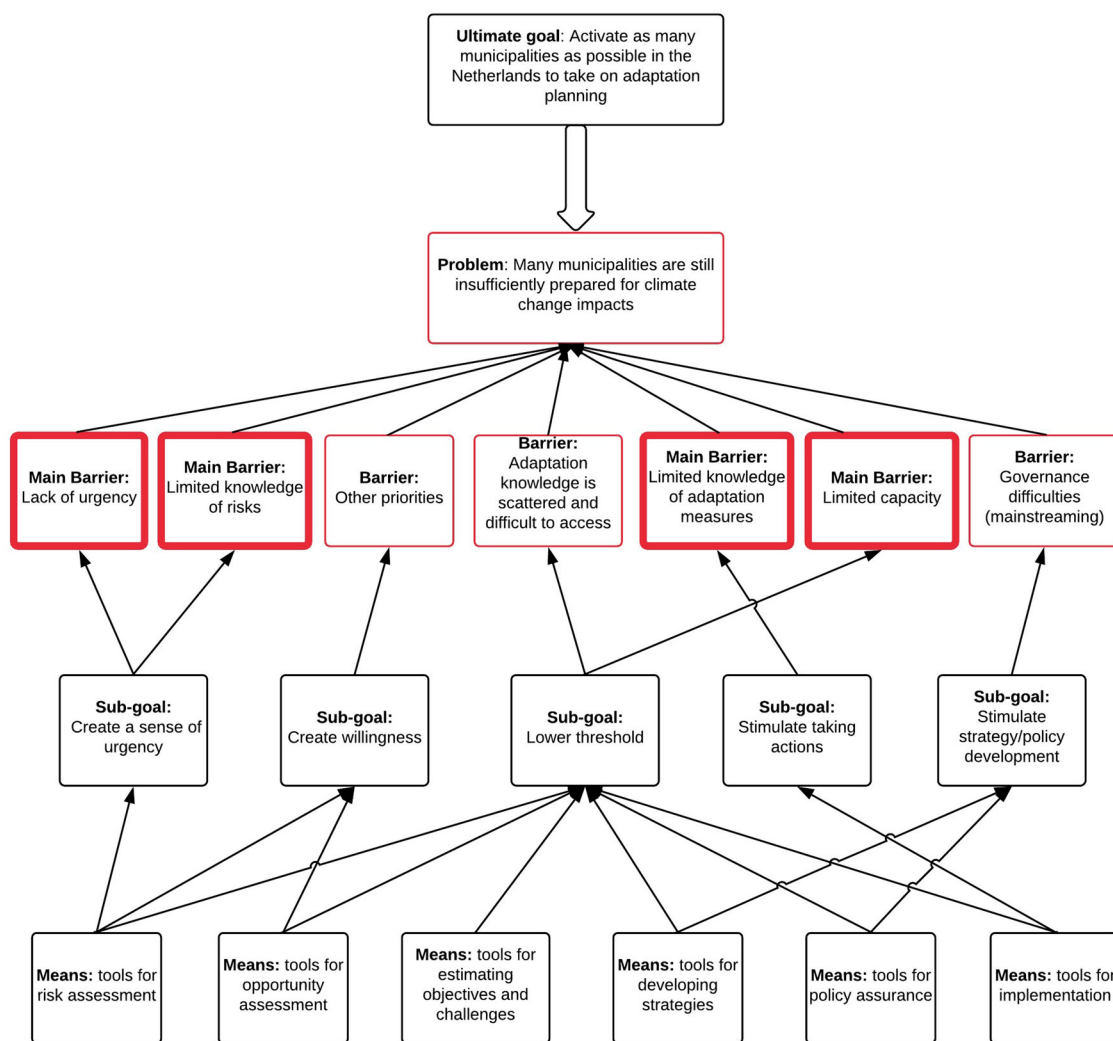


Figure 3. Match between the communicative tools and the perceived key barriers.

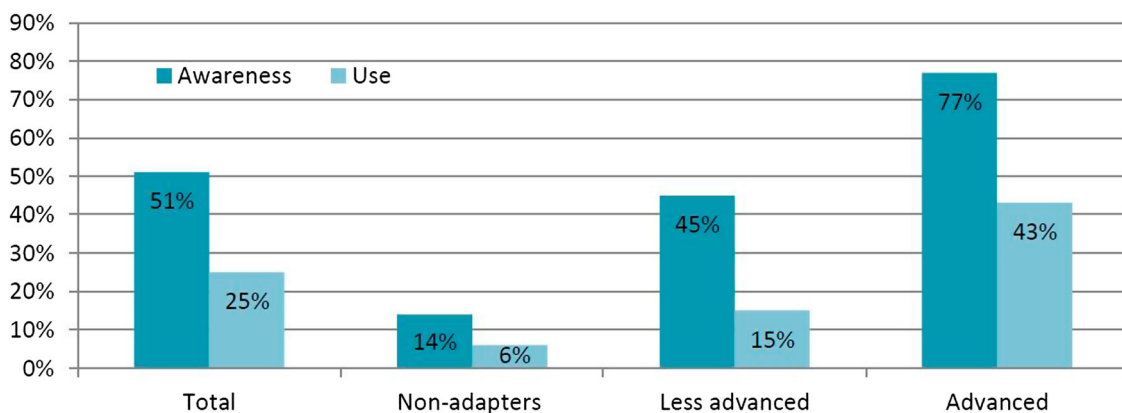


Figure 4. Awareness and use of the SAKP tools.

You can find useful tools, but at some point you get stuck because you cannot make the next step - for example, the mapping of societal costs and benefits, the risks of a specific area. So more concrete, more practice-oriented and location-specific tailor-made knowledge would be nice.

So, according to the advanced municipalities, the tools are primarily useful for alleviating the key barriers to adaptation planning of the less advanced municipalities, because the tools make municipalities aware of local risks and vulnerabilities and create a first sense of urgency. This is confirmed by the fact that of the 8 (53%) less advanced municipalities who have used the tools, 6 (75%) find them useful. As the municipality of Wageningen expressed:

We experience a lack of knowledge of the potential local risks of climate change. Therefore, we need a quick scan that allows us to map the primary and secondary effects of climate change which is not available.

After having a first look at the available tools:

These tools seem to correspond to our desire for knowledge and quick scans. Based on this first impression they seem very useful.

The opinion of the advanced municipalities is that the tools are less suitable for them: their need for more concrete data and information on local risks has increased along with their progress in adaptation. Furthermore, the knowledge barrier that advanced municipalities confront is primarily related to the 'newer perceived' risks such as heat stress and drought, and rather under-addressed issues such as insect plagues. The tools currently available are not considered relevant for addressing these more 'advanced' adaptation topics. Of the municipalities that are aware of the tools, but do not use them ($n = 20$), a lack of urgency and capacity appear to be the main reasons for not using the tools. As a smaller municipality expressed:

There is not yet an emergency, and we have limited capacity. Furthermore, we have explored the risks to a certain extent. Intuitively we know, so there is a limited need for more scans in this area.

To summarize, risk assessment tools are considered most useful for less advanced municipalities. These tools are not specific enough for more advanced municipalities. Advanced municipalities need more sophisticated tools that also address new adaptation topics and are relevant for policy implementation. However, those tools are the least developed. Given the moderate use and low perceived usefulness, it can already be concluded that the effectiveness of the tools in practice is rather low. In the following sub-sections, we will further discuss the use and usefulness of the communicative tools for addressing each of the key perceived barriers.

4.2.3. Creating a sense of urgency

The tools for risk assessment are most appropriate for creating a sense of urgency. However, municipalities that do not consider adaptation planning at all urgent, are often not prepared to invest time and money in tools for risk assessment. Nevertheless, the tools for risk assessment are likely to be relevant for municipalities that are taking initial steps in adaptation planning, as the tools provide initial insights into local risks and vulnerabilities. This is also confirmed by advanced municipalities that have experience with the risk assessment tools. However, as the tools do not generally provide data that is concrete enough to assess location-specific vulnerabilities, it remains difficult to significantly increase the sense of urgency.

4.2.4. Provision of knowledge

The tools for risk assessment seem more relevant to address the knowledge barrier than the urgency barrier, as they offer a substantial amount of information on risks in general. Advanced municipalities that are familiar with the tools for risk assessment perceive them as particularly relevant for less advanced municipalities. This is again explained by the rather generic picture of the potential local risks and the absence of context-specific data.

The vast majority (84%) of advanced municipalities are taking adaptation measures for multiple risks. However, the tools to support implementation are hardly used. Municipalities that have used tools for implementation are generally positive. The tools that promote the sharing of experiences and that provide examples of adaptation measures are considered particularly valuable. However, the majority of municipalities are not aware of these tools, as several stated that they would be interested in tools for sharing the practical experiences of similar municipalities. Municipalities that are more critical of the tools mention a lack of technical

and context-specific data. They also critique the strong focus on spatial adaptation and the lack of tools to increase societal involvement.

4.2.5. Building capacity

These tools are mostly used by advanced municipalities. An explanation for this is that the capacity barrier often prevents smaller municipalities from even exploring the potential of the tools. The tools are therefore primarily relevant for municipalities that have the initial capacity and sense of urgency to start working on adaptation planning. The tools allow these municipalities to acquire knowledge more efficiently. Since the tools are not able to sufficiently address the capacity barriers of municipalities for which this barrier is the most significant, the effectiveness of the tools in practice is limited.

5. Discussion

This article has demonstrated that, despite being effective in theory, the effectiveness in practice (use and usefulness) of the Dutch communicative tools is rather limited in addressing the key perceived municipal barriers. In particular, the less advanced Dutch municipalities for whom the tools would be very useful are less familiar with the tools. The tools are thus not able to motivate the less advanced municipalities which are hindered in their progress by the key barrier of a lack of urgency.

Our finding that tools of a generic nature are not useful for advanced municipalities reconfirms earlier studies showing that there is often a misfit between what is needed at the local level and what is actually provided by the national government (Urwin & Jordan, 2008). This is problematic, in light of the fact that there is a strong need for national level guidance for local governments in adaptation governance (e.g. Amundsen et al., 2010; Storbjörk, 2007; Urwin & Jordan, 2008). Such guidance can benefit from more in-depth studies of the factors that influence the effectiveness of communicative tools. First, the characteristics of the tools themselves may matter. Recent research suggests that the usability of communicative tools depends on the tool's ability to visualize vulnerabilities in an understandable way, and whether it can be tailored to the local situation by adding local geospatial information (Boon, 2017). Second, more insight is needed into the characteristics of the municipalities that actually use the tools. These municipalities may have better access to the national government or research institutes, because of their involvement in joint projects or the existence of personal connections. All but one of the municipalities in this research that were also involved with the development of the SAKP are advanced municipalities, indicating that the involvement of less advanced municipalities with the development of the SAKP was limited. Although it is unlikely that this has led to the tools being of no use for less advanced municipalities, as the vast majority of them expected the tools to be useful, it could help explain the lack of awareness of the tools amongst this part of the target group. Moreover, municipalities that use the tools may be more vulnerable to climate change or may have suffered from recent extreme events. So, more contextualization is needed to improve our insights into the effectiveness of communicative tools.

Since earlier research has seriously challenged the effectiveness of communicative tools in obtaining the desired policy goal (Adler & Pittle, 1983; Weiss & Tschirhart, 1994), one could question whether communicative tools are perhaps too soft to motivate municipalities, even more so in the phase of taking adaptation measures than in the phase of problem recognition. A study among a large sample of local authorities in the UK has shown that adaptation barriers vary over time. Since most local authorities in the UK have overcome the 'climate information usability gap', the most predominant barrier in the phase of taking climate adaptation measures in the UK appears to be a lack of funding (Porter et al., 2015). This may well require the use of economic rather than of communicative tools. Porter et al. (2015) also suggest that a regulatory instrument such as the UK National Indicator 188, which obliged local authorities to report on their climate adaptation performances, has had considerable influence on progress in adaptation planning. Other research has also shown that the use of instrument mixes is generally more effective than the use of single instruments. By combining instruments, it is possible to compensate for any weaknesses of single instruments (Glasbergen, 1992; Henstra, 2016; Mees et al., 2014; Taylor, Pollard, Rocks, & Angus, 2012; Weber, Driessen, & Runhaar, 2014). However, the tailoring of such combinations deserves further reflection.

6. Conclusion

In this article, the extent to which the communicative tools employed by the Dutch national government are effective, in theory and in practice, in addressing the barriers to municipal climate change adaptation has been analysed. This analysis has shown that, *in theory*, the key barriers to climate adaptation by municipalities are addressed by the communicative tools offered by the Dutch government. Since a lack of knowledge is one of the key barriers, it seems logical to use information-based tools to overcome this barrier. However, this study also shows that the effectiveness *in practice* of the communicative tools is rather moderate: half of the municipalities are not aware of their existence, and an even smaller number of municipalities are actually using them. Moreover, their usefulness is also questioned. The more advanced municipalities that have had some experience in using the tools, claim that they are not specific enough for their local contexts. So far, the communicative tools have failed to bridge the 'climate information usability gap'.

Thus, if national governments want adaptation planning to be treated more urgently, they must raise the awareness of the tools' existence with less advanced municipalities. In order to make the tools more relevant for more advanced municipalities, they need to be made more context-specific and need to address a wider range of climate risks. One way of addressing this is to set up communities of practice, in which practitioners and tool developers exchange ideas and discuss steps forward. The national government has recently set up such a community of practice in the form of a knowledge-sharing platform on spatial adaptation to climate change (in Dutch: 'Stimuleringsprogramma Ruimte Adaptatie'). This programme aims to stimulate lower levels of government and other societal actors to integrate water and climate issues into spatial developments, mainly through thematic seminars. Hence, the national government has expanded the number of communicative tools to stimulate adaptation planning and action with municipalities, but at the time of this study, this programme could not yet be included in our analysis.

That being said, other researchers suggest that communicative tools could be accompanied by more powerful tools, such as economic or even legal policy instruments, especially to overcome barriers to taking concrete adaptation measures. The national government could follow the Danish example and make the drafting of municipal climate adaptation strategies obligatory. Whether and to what extent such more powerful tools are employed, however, is inherently a political choice. Politics must decide on the acceptability of risks and ways of addressing them.

Note

1. All quotes are translated from Dutch.

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References

- Adler, R. S., & Pittle, R. D. (1983). Cajolery or command: Are education campaigns an adequate substitute for regulation. *Yale Journal on Regulation*, 1, 159–194.

- Amundsen, H., Berglund, F., & Westskog, H. (2010). Overcoming barriers to climate change adaptation – a question of multilevel governance? *Environment and Planning C: Government and Policy*, 28, 276–289.
- Archie, K. M., Dilling, L., Milford, J. B., & Pampel, F. C. (2014). Unpacking the 'information barrier': Comparing perspectives on information as a barrier to climate change adaptation in the interior mountain West. *Journal of Environmental Management*, 133, 397–410.
- Basit, T. (2010). Manual or electronic? The role of coding in qualitative data analysis. *Educational Research*, 45 (2), 143–154.
- Biesbroek, G. R., Swart, R. J., Carter, T. R., ... Rey, D. (2010). Europe adapts to climate change: Comparing national adaptation strategies. *Global Environmental Change*, 20(3), 440–450.
- Biesbroek, G. R., Termeer, C. J. A. M., Klostermann, J. E. M., & Kabat, P. (2014). Analytical lenses on barriers in the governance of climate change adaptation. *Mitigation and Adaptation Strategies for Global Change*, 19, 1011–1032.
- Boon, E. *Climate proofing municipalities with usable information, improving the usability of climate information to support local adaptation planning through an evaluation of the climate Atlas by municipal practitioners in medium-sized municipalities in the Netherlands (Master thesis Sustainable Development)*. Utrecht University.
- Brukas, V., & Sallnäs, O. (2012). Forest management plan as a policy instrument: Carrot, stick or sermon? *Land Use Policy*, 29(3), 605–613.
- Bulkeley, H. (2013). *Cities and climate change*. London: Routledge.
- Carter, J. G., Cavan, G., Connelly, A., Guy, S., Handley, J., & Kazmierczak, A. (2015). Climate change and the city: Building capacity for urban adaptation. *Progress in Planning*, 95, 1–66.
- Concito. (2016). *Nordeuropæiske erfaringer med klimatilpasning* [Climate adaptation experiences in Northern Europe]. Retrieved from https://concito.dk/files/dokumenter/artikler/nordeuropaeiske_erfaringer_med_klimatilpasning.pdf?language=en
- Den Exter, R., Lenhart, J., & Kern, K. (2015). Governing climate change in Dutch cities: Anchoring local climate strategies in organization, policy and practical implementation. *Local Environment*, 20(9), 1062–1080.
- Forsberg, B., Orru, H., Åström, C., Berencsi, G., Zuurbier, M., & Van den Hazel, P. (2012). *Climate-TRAP Deliverable D8: Report on capacity and impact assessment*.
- Glasbergen, P. (1992). Seven steps towards an instrumentation theory for environmental policy. *Policy and Politics*, 20(3), 191–200.
- Gunningham, N., & Sinclair, D. (2002). *Leaders and laggards: Next-generation environmental regulation*. Sheffield: Greenleaf.
- Henstra, D. (2016). The tools of climate adaptation policy: Analysing instruments and instrument selection. *Climate Policy*, 16(4), 496–521.
- Hood, C. (1983). *The tools of government*. London: Macmillan.
- Hoogerwerf, A. (1990). Reconstructing policy theory. *Evaluation and Program Planning*, 13(3), 285–291.
- Hoppe, T., Van den Berg, M. M., & Coenen, F. H. (2014). Reflections on the uptake of climate change policies by local governments: Facing the challenges of mitigation and adaptation. *Energy, Sustainability and Society*, 4(1), 1–16.
- Howlett, M. (2009). Governance modes, policy regimes and operational plans: A multi-level nested model of policy instrument choice and policy design. *Policy Sciences*, 42(1), 73–89.
- Kautto, P., & Similä, S. J. (2005). Recently introduced policy instruments and intervention theories. *Evaluation*, 11 (1), 55–68.
- KNMI. (2016). *Hoe vaak komt extreme neerslag zoals op 28 juli tegenwoordig voor, en is dat anders dan vroeger?* Retrieved from <https://www.knmi.nl/kennis-en-datacentrum/achtergrond/hoe-vaak-komt-extreme-neerslag-zoals-op-28-juli-tegenwoordig-voor-en-is-dat-anders-dan-vroeger>
- LeCompte, M. D. (2010). Analyzing qualitative data. *Theory Into Practice*, 39 (3), 146–154.
- Leeuw, F. L. (2003). Reconstructing program theories: Methods available and problems to be solved. *American Journal of Evaluation*, 24 (5), 5–20.
- Lemos, M. C., Kirchhoff, C. J., & Ramprasad, V. (2012). Narrowing the climate information usability gap. *Nature Climate Change*, 2(11), 789–794.
- Measham, T. G., Preston, B. L., Smith, T. F., Brooke, C., Goddard, R., Withycombe, G., & Morrison, C. (2011). Adapting to climate change through local municipal planning: Barriers and challenges. *Mitigation and Adaptation Strategies for Global Change*, 16, 889–909.
- Mees, H. (2017). Local governments in the driving seat? A comparative analysis of public and private responsibilities for adaptation to climate change in European and north-American cities. *Journal of Environmental Policy and Planning*, 19(4), 374–390.
- Mees, H., Dijk, J., Van Soest, D., Driessen, P., Van Rijswijk, M., & Runhaar, H. (2014). A method for the deliberate and deliberative selection of policy instrument mixes for climate change adaptation. *Ecology and Society*, 19(2). Article no. 58.
- MKB. (2013, October). *Manifest Klimaatbestendige Stad. Nu bouwen aan de stad van de toekomst*. Retrieved from file:///C:/Users/mees0103/AppData/Local/Google/Chrome/Downloads/manifest_klimaatbestendige_stad.pdf
- Moser, S. C. (2010). Communicating climate change: History, challenges, process and future directions. *Wiley Interdisciplinary Reviews: Climate Change*, 1(1), 31–53.
- Moser, S. C., & Ekstrom, J. A. (2010). A framework to diagnose barriers to climate change adaptation. *PNAS*, 107(51), 22026–22031.
- NRC. (2016). *Dode en veel overlast door regenval en onweer*. Retrieved from <https://www.nrc.nl/nieuws/2016/06/23/stevige-wateroverlast-en-problemen-op-de-weg-door-regen-a1406337>
- Porter, J. J., Demeritt, D., & Dessai, S. (2015). The right stuff? Informing adaptation to climate change in British local government. *Global Environmental Change*, 35, 411–422.
- Preston, B. L., Mustelin, J., & Maloney, M. C. (2015). Climate adaptation heuristics and the science/policy divide. *Mitigation and Adaptation Strategies for Global Change*, 20(3), 467–497.
- Rammer, W., Schauflinger, C., Vacik, H., Palma, J. H. N., Garcia-Gonzalo, J., Borges, J. G., & Lexer, M. J. (2013). A web-based toolbox approach to support adaptive forest management under climate change. *Scandinavian Journal of Forest Research*, 29(1), 96–107.

- RIONED. (2013). *Inventarisatie regenwateroverlast in de bebouwde omgeving 2013 (RIONED reeks 17)*. Retrieved from https://www.riool.net/product?p_p_auth=ULIBvn38&p_p_id=56_INSTANCE_N1Ki9Et3iC4R&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_pos=1&p_p_col_count=2&_56_INSTANCE_N1Ki9Et3iC4R_groupId=10180&_56_INSTANCE_N1Ki9Et3iC4R_articleId=7775#
- Runhaar, H., Mees, H., Wardekker, A., Van der Sluijs, J., & Driessen, P. P. J. (2012). Adaptation to climate change-related risks in Dutch urban areas: Stimuli and barriers. *Regional Environmental Change*, 12, 777–790.
- Schneider, A., & Ingram, H. (1990). Behavioral assumptions of policy tools. *The Journal of Politics*, 52(2), 510–529.
- Storbjörk, S. (2007). Governing climate adaptation in the local arena: Challenges of risk management and planning in Sweden. *Local Environment*, 12(5), 457–469.
- Taylor, C., Pollard, S., Rocks, S., & Angus, A. (2012). Selecting policy instruments for better environmental regulation: A critique and future research agenda. *Environmental Policy and Governance*, 22(4), 268–292.
- Urwin, K., & Jordan, A. (2008). Does public policy support or undermine climate change adaptation? Exploring policy interplay across different scales of governance. *Global Environmental Change*, 18, 80–191.
- Vedung, E., Bemelmans-Videc, M. L., & Rist, R. C. (1998). *Policy instruments: Typologies and theories. Carrots, Sticks, and Sermons: Policy Instruments and Their Evaluation*, 5, 21–58.
- Weber, M., Driessen, P. P. J., & Runhaar, H. A. C. (2014). Evaluating environmental policy instruments mixes; a methodology illustrated by noise policy in the Netherlands. *Journal of Environmental Planning and Management*, 57(9), 1381–1397.
- Weiss, J. A., & Tschirhart, M. (1994). Public information campaigns as policy instruments. *Journal of Policy Analysis and Management*, 13(1), 82–119.
- WMO. (2013). *The Global Climate 2001-2010: a decade of climate extremes - Summary Report 1119*. World Meteorological Organization.
- Wuijts, S., Vros, A. C., Schets, F. M., & Braks, M. A. H. (2014). *Effecten van klimaat op gezondheid: Actualisatie voor de Nationale Adaptatiestrategie (2016)*. RIVM rapport 2014-0044.

Appendix: Questionnaire

Questionnaire for the CAS director

1. What was the thought process behind the development of the SAKP and its tools?
2. What is the (main) purpose of the SAKP and its tools?
3. What is the main problem that the SAKP and its tools try to solve?
4. What do you think are the causes of this problem?
5. What do you expect to be the main barrier for municipalities to work on adaptation planning?
6. Which barriers are addressed by the SAKP and its tools?
7. What do you think are the most important and effective tools of the SAKP?
8. What do you expect municipalities to be able to achieve with SAKP's tools and information?
9. What would be interesting for the SAKP to find out through this research on perception and use of the SAKP by municipalities?

Questionnaire for municipalities

1. What do you believe to be the most important local risks of climate change? Do you expect these effects to increase in the coming years?
2. Is the municipality involved in adaptation planning? If not, why not?
3. Which departments are involved and what are their responsibilities?
4. Which specific climate change adaptation measures does the municipality take (for which risks)?
5. Is there cooperation for adaptation with other parties?
6. Is there contact with society related to adaptation?
7. Do you experience (or have experienced in the past) any barriers to adaptation planning?
8. What do you consider the main barrier to adaptation planning, and for what reason?
9. How do you deal with these barriers?
10. Is there any form of support desired that could help overcoming these barriers to adaptation planning? Please explain.
11. Are you familiar with the support tools (KRA)?
12. Are any of these tools (currently, or in the past) being used? If so, which one(s) and for what specific purpose? If not, why not?
13. Do you have any recommendations for improvement?
14. What do you believe to be the value of the support tools by KRA?
15. Do you believe (one of) these tools are suitable for overcoming the barriers previously mentioned? What about the main barrier? If so, why/how? If not, why not?