STIMULI FOR MUNICIPAL RESPONSES TO CLIMATE ADAPTATION: INSIGHTS FROM PHILADELPHIA – AN EARLY ADAPTER

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ABSTRACT

An in-depth understanding of these stimuli is currently lacking in literature as most research has focussed on overcoming barriers to climate adaptation. The aim of this paper is to identify stimuli for municipal responses to climate adaptation and examine how they influence the governance approach to addressing climate adaptation through explorative case study research. Fort this, an early adapter was selected as case: Philadelphia (USA). By reconstructing the organization of two municipal responses to climate adaptation in this city, we have been able to identify stimuli and gain insight in the city's governance approach. The reconstruction is based on data triangulation that consists of semi-structured interviews with actors involved in these responses, policy documents and newspaper articles. The research illustrates the importance of stimuli such as strategically framing climate adaptation within wider urban agendas, political leadership and institutional entrepreneurs. Moreover the research reveals that it is the combination of stimuli that influences the governance approach to climate adaptation. Some stimuli will trigger a dedicated approach to climate adaptation, while others initiate a mainstreaming approach. This research is important especially to municipalities to recognize stimuli within their own (policy) context and subsequently, make informed decisions to exploit all or some of these stimuli to initiate a governance approach to climate adaptation.

Key words Climate adaptation, Stimuli, Governance approaches, Philadelphia, Institutional entrepreneurship, Political leadership

INTRODUCTION

Several cities have already demonstrated awareness of the potential risks of climate change and have organized municipal responses to climate adaptation; see for example New York, Philadelphia, Chicago, Vancouver, London, Rotterdam and Copenhagen (Castan Broto & Bulkeley 2013; Bulkeley & Tuts 2013). With their responses, these early adapter cities aim to anticipate the expected changes in climate, such as an increase in temperature, more precipitation events and sea level rise (IPCC 2007); and circumvent possible associated consequences such as economic damages induced by urban flooding, and social disruption due to heat stress. Many researchers have argued that cities should start adapting to climate

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change today in order to avoid the high costs that are associated with future damages (Runhaar *et al.* 2012; Tompkins *et al.* 2010). By addressing these consequences of climate change, these cities have taken up a major challenge in urban policy. However, many other cities have not done so thus far (Reckien et al. 2014).

In climate adaptation literature, the focus has largely been on why these cities have not been able to address climate adaptation. This has resulted in many studies on the identification and understanding of barriers to climate adaptation. Frequently mentioned barriers are, for example, uncertainty about the risks and impacts, limited financial resources, little local expertise, a lack of political support, and an undefined role for local governments (Bulkeley and Betsill 2013, Runhaar *et al.* 2012, Moser and Ekstrom 2010, Amundsen *et al.* 2010, Sippel and Jenssen 2009). By focusing mainly on the barriers to climate adaptation, the role of stimuli has been largely ignored. By stimuli, we refer to factors that have triggered municipal responses to climate adaptation. It is expected that the early adapters have experienced stimuli that have increased their inclination to respond to climate adaptation, and subsequently assisted in avoiding or overcoming barriers. Hence, the identification of these stimuli for climate adaptation responses is also relevant for understanding and addressing the barriers to climate adaptation. In addition, we want to explore whether the stimuli influence the city's governance approach to climate adaptation. The stimuli encountered by an early adapter might explain why one city applies a more dedicated approach to climate adaptation (i.e. climate adaptation is presented as a new policy domain with direct political commitment, allocated resources and specific adaptation policies) while another city follows the mainstreaming approach in which the focus is on establishing synergies between existing policy objectives and climate adaptation, and combining resources (Uittenbroek et al. 2014; Kok & De Coninck, 2007). By addressing this knowledge gap, we provide more insights into the stimuli which could benefit municipalities in recognizing stimuli within their own (policy) context and subsequently, assist in the exploitation of all or some of these stimuli to initiate a governance approach to climate adaptation.

The aim of this paper is twofold, as we identify stimuli that have triggered municipal responses to climate adaptation and explore whether the identified stimuli have influenced the governance approach. To clarify, our aim is not to qualify the success of the climate adaptation responses or the governance approach taken. The research is empirically exemplified by an explorative case study, which is considered a best practice when it comes to climate adaptation. For the case study, we have selected the City of Philadelphia in the United States. This case selection is based on previous research that has shown that Philadelphia has organized several municipal responses to climate adaptation (see for example Edwards 2013; Maimone *et al.* 2011; Rosenzweig *et al.* 2010). By reconstructing the organization of two of these responses, we have been able to identify stimuli and gain insight in the city's governance approach. The case study is based on data triangulation that consists of interviews with actors involved in these climate adaptation responses, policy documents and newspaper articles. The research question is as follows: *what stimuli have triggered municipal responses to climate adaptation in Philadelphia and how have these stimuli influenced the city's governance approach to climate adaptation?*

In the next section, a theoretical framework is presented which includes a literature overview of possible stimuli for triggering responses to climate adaptation. This is followed by the research design and introduction to the case study. The following two sections present the qualitative analysis of the stimuli for two policy programs in Philadelphia (Greenworks and Green City Clean Waters) and how these stimuli have influenced the city's governance approach to climate adaptation. These two policy programs could be considered as a municipal response in themselves, but also provide structure for (further) municipal responses. In the final section, the main conclusions are drawn.

THEORETICAL FRAMEWORK

Although the main focus in climate adaptation literature has been on the identification and understanding of barriers, few researchers have highlighted possible stimuli for climate adaptation (e.g. Bulkeley et al. 2009; Bassett and Shandas 2010). Thus far, the presentation of these stimuli has been somewhat scattered throughout climate adaptation literature. To provide structure, we developed a theoretical framework by following the questions 'who, when, why and how'. These basic questions assist in identifying the different stimuli for climate adaptation responses independently as well as allowing for an exploration of whether there are any interdependencies between the stimuli. Additionally, this framework assists in identifying stimuli in the case study. While we aim to be thorough in our overview of stimuli, we want to stress that the overview is not exhaustive.

The identification of possible stimuli for climate adaptation responses

First, *who* is about the people who initiate the municipal response. In adaptation literature, much attention is given to institutional entrepreneurs (e.g. Wejs *et al.* 2014), also referred to as policy entrepreneurs (Bassett and Shandas 2010; Bulkeley 2010; Kingdon 2002; Meijerink & Huitema 2010) or local champions (Carmin *et al.* 2012). These entrepreneurs take up the role of mobilizing other actors and building legitimacy for climate adaptation (Wejs *et al.* 2014) and can be positioned both inside and outside the municipal organization (Kingdon 2002). Institutional entrepreneurship is demonstrated by individuals as well as by collectives. Meijerink & Huitema (2010) point out that collective entrepreneurship holds two main advantages as the coalition between people in different positions can apply various strategies and possess a variety of capabilities and tools. Several researchers have argued that without institutional entrepreneurs, the organization of municipal responses to climate adaptation is difficult (e.g. Bassett and Shandas 2010; Betsill and Rabe 2009; Carmin *et al.* 2012). On the other hand, Bulkeley (2010) points out that while institutional entrepreneurship is important in the initial stages of organizing local responses to climate adaptation, a broader institutional capacity is necessary to overcome barriers that could derive from party politics or existing organizational structures. The involvement of (elected) politicians is often mentioned as an equally important stimulus in organizing municipal responses to climate adaptation. Politicians who demonstrate leadership can contribute directly by allocating resources (Carmin *et al.* 2012), but also more indirectly by stimulating learning processes. Politicians, who do actively adapt, might choose responses that are quick wins and visible and no-regret measures (such green roofs) in order to increase their political profile (Uittenbroek *et al.*

2014). However, politicians sometimes also choose to make statements about what should be done in the long run, or apply cover up strategies like setting up new research programs dates for future adaptation strategies instead of proactive adaptation (Termeer 2009). In this way, the politicians avoid taking decisions that could damage them politically (Biesbroek *et al.* 2009).

Second, *when* is about momentum. A momentum provides an opportunity in time to adapt to climate change. Kingdon (2002) refers to this as a window of opportunity. In the case of climate adaptation, this can be a calamity or focus event (e.g. a flood or a heat wave), elections or societal pressure (Dannevig *et al.* 2013; Runhaar *et al.* 2012). For example, the City of Copenhagen dealt with a cloud burst in 2011. The damage costs of the cloudburst were more than one billion euro. This calamity triggered a municipal response, to invest in climate adaptation measures and develop a specific cloudburst plan (Madsen *et al.* 2013). Kingdon (2002) argues that it is often a set of circumstances in which the coupling of problems-solutions in a favorable context provides the opportunity for change (Birkman *et al.* 2010).

Third, *why* relates to the applied narrative or framing that motivates authorities to address climate adaptation. By framing a topic a certain way, it is possible to increase its salience (Entman, 1993; Pralle 2009). Fünfgeld and McEvoy (2011) identified four common framings of climate adaptation: the hazard frame, the vulnerability frame, the risk management frame and the resilience frame. Whereas the first two frames illustrate the consequences of climate change and a lack of adaptation, the latter two are more opportunistic as they describe what the city can do or become if it adapts to climate change. In addition to framing climate adaptation explicitly, Bulkeley and Betsill (2013) argue that several municipal organizations have addressed the need for climate adaptation more implicitly by placing it within wider urban agendas and exploring ways to use existing policy and planning processes to respond to climate change. By using concepts and terms closely related to the current framings in a policy domain, it is possible to signify the relevance of climate adaptation within that domain, and increase the understanding of, and support to act upon climate adaptation (Uittenbroek *et al. in press*).

Fourth, *how* refers to the available capability to respond to climate adaptation. The capability to organize municipal responses can take many forms. This can vary from available and allocated resources to political pressure as well as the ability to install new regulations and skills to build networks and coalitions. Smith *et al.* (2009) argue that climate adaptation cannot be realized with just the existing resource streams and that the mobilization and allocation of resources for climate adaptation needs attention. This requires support for climate adaptation, and the building of new coalitions and networks. However, in order to connect actors that have different values and objectives, the capabilities of advocacy, brokerage and perseverance are probably required (Kingdon 2002; Meijerink & Huitema 2010). Access to such capabilities implies that there are opportunities for negotiation and exploitation.

There are interdependencies between the stimuli as it takes an individual to recognize the momentum, create the narrative and practice the capability. This is not necessarily done by the same individual. By looking at the interdependencies between the stimuli, it highlights the different kinds of people (with various capabilities and tools) who are necessary to organize municipal responses to climate adaptation.

Stimuli and their possible influence on the governance approach

As early adapters encounter possible stimuli and exploit these stimuli to initiate municipal responses to climate adaptation, they also start to develop a governance approach to climate adaptation. This governance approach is a guideline for how following climate adaptation responses are organized. In adaptation literature, two frequently mentioned governance approaches to climate adaptation are the dedicated approach and the mainstreaming approach (see e.g. Kern & Alber 2008; Uittenbroek *et al.* 2014). In a dedicated approach, climate adaptation is understood as a main objective that requires its own resources and special policies. It is considered as a new policy domain. In this approach, the focus is on achieving conformance between the set adaptation goals and the realized outcomes (Uittenbroek *et al.* 2013). The mainstreaming approach aims to integrate climate adaptation as an objective in existing policy domains. This means that synergies between existing policy objectives and climate adaptation are established and that existing resources are used to address climate adaptation. As opposed to the dedicated approach, mainstreaming focuses on performance-based decision-making – i.e. actors focus on to what extent climate adaptation is required and feasible within the given context. This could imply that the realized outcome is less than the set adaptation goals, but this is a valid outcome as long as it is based on a deliberate assessment (Uittenbroek *et al.* 2013; Faludi 2000). In table 1, the differences between the two approaches are named. We are aware that other governance approaches are possible as well, for example a hybrid approach in which the two approaches alternate or co-exist within one city (Uittenbroek *et al*. 2014).

Table 1 The dedicated approach and the mainstreaming approach

It is expected that not all stimuli for climate adaptation responses described in the former paragraph will result in the same governance approach. For example, not all individuals will have the capability to install a new policy domain with its own resources and policy goals. This might only be the case if politicians show leadership and commit to climate adaptation. In that case, political leadership could be considered as a stimulus that influences a dedicated approach. Other stimuli, such as the use of strategic framing to establish synergies or the presence of institutional entrepreneurs, might then again result in a governance approach that resembles mainstreaming. In the following sections, the case study analysis explores to what extent this proposition about the influence of stimuli on the governance approach can be supported.

DATA AND METHODS

The analysis presents a singular explorative case study of an early adapter, offering tentative conclusions for stimuli that can trigger municipal responses to climate adaptation and the

influence of these stimuli on the governance approach. According to Flyvbjerg (2006), a single case study can provide valid research outcomes if the case in question is expected to be rich and illustrative enough. We believe that Philadelphia presents such a case.

The City of Philadelphia is expected to deal with several impacts of climate change, such as an increase in hot weather events in summer, more frequent and prolonged heat-waves, and the increase of heavy downpour events as well as the provision of fresh water for both drinking and industrial use (Bulkeley 2013). From previous research, we learned that the City of Philadelphia is adapting to these climatic changes. For example, together with the non-profit Energy Coordinating Agency, the city installed a heat alert program in 1995 (Kalkstein et al. 1996; Gartland 2008) and more recent municipal responses aim to make the city's infrastructure resilient and reduce combined sewage overflow, which can be worsened by an increase in downpour events and consequently affect the provision of fresh water (Maimone et al. 2011; Bulkeley 2013). Furthermore, the City of Philadelphia participates in the C40 Cities network and produced a climate change action plan in 2007, but this plan mainly focused on climate mitigation measures.

In addition to the climate change challenges, the city has been struggling in the past decades with urban decay due to departing industries, a declining population and an increase in vacant land (Edwards 2014). Through urban regeneration, the population has increased again in the past decade. The city still has to address social issues like urban degeneration (the city counts around 40,000 vacant parcels) and poverty (28 per cent of the population live below the poverty line) (interview MOS01[1] 2013). This illustrates that Philadelphia has many (short-term) issues to address, which makes it interesting to learn what stimuli have triggered municipal responses to climate adaptation – since this is often considered a long-term issue (Biesbroek *et al.* 2009).

In December 2013, semi-structured interviews were held with actors responsible for policy design and implementation in various policy domains – sustainability, spatial planning and water management. We asked them to explain how their policy domain was currently addressing climate adaptation. We did not ask the actors to identify stimuli themselves, but rather to provide a reconstruction of the process of policy design and implementation of the climate adaptation response they were working on. For the two programs Greenworks and Green City Clean Waters, the process has been reconstructed. We selected these two programs, because at time of research these were the most actively pursued and hence, furthest in planning and implementation.

In total, 17 actors were interviewed. Most of these actors worked for the municipality directly, although some of them were consultants hired for their expertise. A list of the actors and their job positions can be found in appendix 1. Some of the interviews were held in a group meeting with a maximum of five people. Additionally, field trips in Philadelphia were made to study several projects that have been realized within Green City Clean Waters. Two actors were contacted through e-mail as meetings could not be arranged during the fieldwork in Philadelphia. Prior to the interviews, we analyzed all policy documents that related to sustainability, climate change, spatial planning and water management – so this also included

responses other than Greenworks and Green City Clean Waters. In addition to the interviews and policy document analysis, we analyzed newspaper articles and other online available material such as websites and You Tube movies.

It should be pointed out that although Philadelphia is considered an early adapter, we learned during our fieldwork that the municipal responses were not necessarily taken solely to adapt to climate change. In the following two sections, Greenworks and Green City Clean Waters are introduced. Their policy design and implementation process is reconstructed while using the theoretical framework.

4 GREENWORKS

During the elections of 2007, a group of organizations had formed a coalition that focused on creating safer, healthier and cleaner neighborhoods. This coalition was called Next Great City and consisted of 130 organizations with different backgrounds (e.g. environmental, businesses, faith, community, union) (Next Great City 2014). The coalition created a list of ten action steps that would lead to a more sustainable city (see table 2). The action steps of reducing sewer backups and flooding (no. 4) as well as replanting trees and creating green lots (no. 7 and 9) are indirectly linked to climate adaptation: sewer backups and flooding are caused by downpours and more green infrastructure can reduce heat mortality and soak up rainwater. The Next Great City coalition was in no way connected to the municipal organization, but demanded political leadership and commitment in making Philadelphia a sustainable city. Because the diverse groups had united in this coalition, they could reach out through different channels and gain support, but at the same time speak with one voice – making their message (the ten action steps) clear for politicians to hear. While all the running candidates for mayor could have picked up this list, it was only picked up by one of them. This person anticipated the action steps and used them to his advantage during his election campaign (interview MOS02 2013). He won the elections and accordingly, as mayor, he showed political leadership by installing a Mayor's office of Sustainability and developing a policy program addressing the ten action steps: this is Greenworks.

Table 2 Ten action steps of the Next Great City coalition

Greenworks includes five goals, 15 targets and around 170 initiatives that need to be realized over a period of seven years (see table 3). The targets are linked to a metric. For example, the target of providing walkable access to park and recreation resources for all Philadelphians is measured in acres of open space. The metrics provide a way to illustrate the yearly progress in a report. The first report was drafted in 2008 by the then policy director of sustainability and a small group of policymakers working on sustainability (interview MOS01; MOS02 2013). They took the ten goals of the Next Great City coalition as a guideline, but also explored what policies the policy departments had already developed that could be placed within the framing of sustainability (interview MOS02 2013). When the then policy director of sustainability was writing Greenworks, he looked at the first generation of sustainability and climate change plans such as those of New York, Chicago, Toronto and Vancouver (interview MOS02 2013) and he picked out the elements which would make the Philadelphia

plan distinctive. “PlaNYC was multidimensional with six issues and Chicago’s plan used metrics [to measure progress]. This spoke to me. So we wanted to take both of these things and put them together. So we ended up with five goals and 15 targets” (interview MOS02 2013). The selection of these goals and targets was strategic. On the one hand, these derive from existing policies and plans of the Philadelphia policy departments and on the other hand, the aim was to distinguish the Philadelphia plan from other cities. As the then policy director said “I am a strategic policymaker, not a sustainability activist. So I was paying attention to what targets New York did not have and that we could add to our list of goals and targets” (interview MOS02 2013).

Table 3 Greenworks – goals, targets and initiatives

In the early progress reports, climate adaptation is not explicitly addressed. Although targets could be affiliated with climate adaptation (for example targets 8, 9, 11 and 13 in table 3), an explicit link is not made in the Greenworks reports of 2009, 2010 and 2011. According to a policy advisor at the Mayor’s office of Sustainability responsible for the implementation of Greenworks, this was on purpose: “It is a messaging thing. We are doing this [addressing climate change] already and although you might not think climate change is happening, these things [goals and targets] are valuable in any case. (…) Climate change does not mean a lot to a lot of people. (…) For us, it is about figuring out how it adds value to everyday life” (interview MOS01 2013). Hence, goals such as energy, environment, equity, economy and engagement, were formulated that could be understood and supported by both politicians and the public. As of 2012, the framing concerning climate adaptation became more explicit and resulted in the aim of developing a special climate adaptation plan. The Mayor’s office realized that they must obtain a better understanding of the impacts of a changing climate in order to achieve their resilient infrastructure target (target 13). A special adaptation plan would provide additional arguments to this and other targets of Greenworks (interview MOS01 2013).

The Mayor’s office of Sustainability is responsible for the implementation of Greenworks. The implementation of the plan means largely that the policy makers of the Sustainability office provide expertise and network to the policy departments who have to realize the targets and initiatives. The office has no budget to assist in financing the initiatives which means that policy departments themselves have to fund and invest in the realization of the targets and initiatives. Furthermore, the office makes the yearly progress report, using the metrics to monitor the progress within the policy departments. The metric entails a baseline, the current status and the 2015 target (for example, target 8 is measured in new greened acres. For this the baseline is zero in year 2011, current status is 102.4 in year 2012 and 2015 target is 450 new greened acres) (Greenworks 2013). The policy departments are responsible for providing the information on the metrics to the Mayor’s office (interview MOS01 2013). For some metrics, the data gathering has been difficult (interview MOS01 2013). According to the then policy director of Sustainability: “[t]he whole idea [of the metrics] was about direction and ambition. And you are going to learn things as you go, and as you go, change the targets. Make them smarter, make them harder, make them easier. Change them, because so you learn” (interview MOS02 2013). Hence, some of the metrics were subjected to alterations. But after

they were officially introduced in the 2012 report, the metrics have not changed. Although the metrics provide a clear measurement for progress, the solution linked to the metric might not necessarily be the only solution to achieve the target. For example, the target to manage stormwater (target 8) is measured in greened acres[2]. PWD, responsible for the metric, spends a lot of time organizing a green acre; while this time could be spent on other measures that manage stormwater but do not necessarily fit within the description of a green acre (interview PWD08 2013).

Greenworks' stimuli

During the analysis, we learned what stimuli have triggered Greenworks. Societal pressure in combination with elections provided the window of opportunity to initiate a new policy program. The Next Great City coalition played a significant (entrepreneurial) role in forming the goals, but it was the mayor who showed leadership and placed the goals on the political agenda. He is responsible for the installment of the Mayor's office of Sustainability and Greenworks. The framing used in Greenworks is that of sustainability in relation to everyday values (such as economy and equity). Climate change is one of the challenges that influences these values and therefore requires attention. Climate adaptation is considered an extra argument for the work that the Mayor's office is already doing, but is to gain more explicit attention in the future. In terms of capabilities and tools, several can be identified: from political power and human resources, to the metrics. It was the mayor's prerogative to install a special office. Yet, although this office has a specific position and function in realizing Greenworks, it only holds human resources – i.e. five policymakers who can provide networking and lobbying skills, but no financial resources. The metrics are a stimulus to enforce the policy departments that are responsible for a certain target, to realize initiatives. If policy departments do not illustrate their progress in the yearly report, this might be noticed by the readers of the report and result in bad publicity for the department. The nature of the response is largely about visibility and political profiling: showcasing what the city is doing (differently than other cities) concerning sustainability and climate change.

The analysis of Greenworks shows that the stimuli, summarized in table 4, have initiated a dedicated governance approach. There is political agenda-setting, a special bureau and policy, and the metrics impose conformance; maybe not conformance between the goal and the outcome, but in terms of how the goal is achieved (e.g. in greened acres). However, it appears that at first, the applied framing is more in line with a mainstreaming approach since climate adaptation is considered an added value to Greenworks' main objective of sustainability. A specific focus for climate adaptation has only been developed recently. This will probably result in municipal responses that more specifically address climate adaptation. The next section will illustrate if similar stimuli and governance approach can be identified in the Green City Clean Waters program.

Table 4 Stimuli for Greenworks

5 GREEN CITY CLEAN WATERS

Green City Clean Waters is a policy program that is designed and implemented by the Philadelphia Water Department. The aim of this response is to deal with the combined sewage overflow. Combined sewage overflow occurs when excessive water in the combined sewage system (a combination of storm- and wastewater) goes untreated in the watershed system. In 1997, the US Environmental Protection Agency enforced the Clean Water Act (1972) and mandated the water department to update their long-term control plan for combined sewer overflow. The water department first looked at traditional grey infrastructure solutions such as sewer pipes. As the costs for the grey infrastructure (estimated at nine billion US dollars) were high, a group of people within the water department started to look at other alternatives such as green stormwater infrastructure (GSI). Examples of GSI are retention and detention ponds, permeable pavement, water crates, tree trenches and green roofs. GSI reduces the effects of urban heat islands, increases the soak-up of rainwater and results in climate change offsets (through carbon sinks) (PWD 2009). An alternative plan based on GSI would require a relatively smaller investment of two billion US dollars (Maimone 2013). In 2009, the water department presented Green City Clean Waters as their updated long-term control plan for combined sewage overflow.

Green City Clean Waters focuses specifically on addressing the future challenges for and pressures on Philadelphia's water system. These challenges vary from environmental (climate change) to social (urban regeneration) and financial (economic crisis) (PWD 2011). According to the water department, "[m]eeting these challenges requires either a significant new investment in infrastructure, or a paradigm shift in our approach to urban water resources" (PWD 2011). Green City Clean Waters aims to deal with 85 per cent of the calculated combined sewage overflow, but it is expected to also obtain economic and social benefits as well as environmental benefits (table 5). For example, the deputy commissioner argued that grey infrastructure will most likely be engineered by companies from abroad, which means that local investments flow out of the community; while GSI can provide green jobs for the community (Channel DEESTUARY 2011). Also, the mayor supports Green City Clean Waters as opposed to the grey infrastructure solution because of the plan's benefits: "We recognized we could save money, not dig up half of town, and improve our parks and green spaces" (Aston 2012).

Table 5 Economic, social and environmental benefits of GSI

The water department is responsible for the design and the implementation of Green City Clean Waters and has approximately two billion US dollars to invest over a 25-year time period. The first five years are used as 'proof of concept'. This means that in this five-year period, pilot projects are set up to 'provide information for optimal design and program development' (PWD 2012, p. 3-2). The entrepreneurs leading the 'proof of concept' actions have initiated several learning processes on different fronts (communication, design and maintenance) in order to stimulate an organizational change. A consultant working for the water department said: "it is a complete learning process. Nobody has done this on this scale. The complexity [of the transition from grey infrastructure to GSI] was what everybody was afraid of. They feel that it is taking away of our core mission" (interview PWD05 2013). Some of the engineers working at the water department have been following routines for a

very long time (interview PWD 02 2013 Brooks). These routines will be subjected to change as the implementation of GSI continues: “We design with the equipment that we have today. But we also have to justify how to alter equipment and routines to make them more cost-effective” (interview PWD 02 2013). Furthermore, GSI requires the PWD to have employees with landscaping skills. Hence, employees are schooled in this, and new employees attracted (interview PWD05; PWD08 2013). The consultant emphasizes that mistakes are allowed during the ‘proof of concept’ period: “It is a change of course. It will not work out as we have envisioned it. We might not make the target in year ten and people get depressed about it [but they should not]. We are making a huge change” (interview PWD08 2013).

In order to implement the plan, the water department also needs to collaborate with other municipal departments, actors in the private sector and the community, as they are no longer putting the solutions underground, but above ground, making them visible and part of other policy domains. The water department has to convince these actors of the benefits of GSI. The water department already learned that other departments can be reluctant to collaborate: “they want to know, ‘what is in it for us?’” (onterview PWD08 2013). Although the water department is eager to implement its plan, its enthusiasm for action can be overwhelming for the other municipal departments. For example, in its contact with the department of Parks and Recreation, the water department sent different people of different levels to every meeting to advocate its plan. This proved intimidating and the water department had to pull back (interview PWD08 2013). The water department had to think of other ways to learn how to integrate GSI in the projects of other departments. For example, the water department placed water managers in other departments in order to learn about the routines of these departments (interview PWD08; PWD02 2013). However, this did not necessarily prove productive as one of the water managers “went native” – i.e. started working for the other department (interview PWD08; PWD02 2013). Overall, the water department noticed that in their collaborations with other departments, they needed to take up tasks that were not part of their job before. For example, they now also search for additional monies so that they can realize the goals of other municipal departments in order to get them to collaborate. An illustrative example is the water department’s application for funding for playground equipment for the department of Parks and Recreation (interview PWD05 2013).

Yet the actions of the water department have not been without success as approximately 400 projects have been completed or are on the way to being accomplished. These are programs in which the water department worked together with neighborhoods communities and school districts (see photo 1 and 2). They also continue to stimulate citizens to invest in GSI solutions by providing information and financial incentives. The stormwater billing initiative is such an incentive. With a change in billing structure from a charge based on a property’s water meter size to charges based on the total size of the property and the amount of impervious area, the water department aims to stimulate property owners to apply GSI solutions. By implementing GSI, property owners can obtain credits that reduce their stormwater fee (interview PWD04 2013; PWD no year).

Photo 1 Kensington High School manages all stormwater on site using green roofs, rain gardens and more. (Focht 2013)

Photo 2 Stormwater planters at Columbus Square Park maintained by the neighborhood community. (PWD 2014)

Green City Clean Waters' stimuli

The stimuli that triggered the window of opportunity for Green City Clean Waters are regulations (Clean Water Act) together with financial limitations (the high costs for grey infrastructure). The Philadelphia Water Department was responsible for making a new plan to address the combined sewer overflow, but it was a group of entrepreneurs within the department who thought to act differently and started to advocate and lobby for another solution: GSI. The framing does not focus solely on climate adaptation, but also addresses other challenges in the city in order to gain support for implementation from other municipal departments and the public. In addition to applying their capabilities of advocacy and brokerage to gain support, the entrepreneurs also focused on knowledge exchange and had the financial resources to organize responses. Moreover, they showed perseverance as illustrated by the 12 year time gap between the Environment Protection Agency's mandate (1997) to the first Green City Clean Waters plan in 2009. They continued to advocate their plan, but adjusted their approach each time a barrier emerged. This demonstrates flexibility. The response focuses on structural organizational change. To learn how to manage this change, the first five year period (proof of concept) focuses on pilot projects, stimulating learning processes and establishing a network.

Interestingly, an important stimulus for Green City Clean Waters was a regulation (Clean Water Act). Overall, regulations require conformance between goal and outcome, which is considered a characteristic of a dedicated approach. Yet the governance approach of Green City Clean Waters resembles a more mainstreaming approach as climate adaptation is part of the policy agenda of the water department and the main focus is on establishing performance within the existing organizational structures. The barrier of financial limitations was used by the institutional entrepreneurs as a stimulus to promote other practices and routines, and to seek synergies between climate adaptation and existing policy objectives inside and outside their policy department. For this, climate adaptation was strategically framed as a solution that results in possible social, economic and environmental benefits. The entrepreneurs use their networks and advocacy skills to establish pilot projects and learning processes. These projects and processes are allowed to fail as long as this leads to new insights, which is in line with performance.

Table 6 Stimuli for Green City Clean Waters

DISCUSSION AND CONCLUSIONS

The aim of this paper has been twofold: first, to provide insight into what stimuli have activated municipal responses to climate adaptation in Philadelphia and second, whether these stimuli influence the governance approach to climate adaptation. In the Philadelphia case, several stimuli can be identified: political leadership, elections (as window of opportunity), institutional entrepreneurship, strategic framing (by stressing multiple benefits of climate adaptation) and several capabilities and tools such as advocacy, perseverance,

flexibility and metrics. To an extent, these findings support the previous work of researchers who have argued the relevance of similar stimuli before; see for example Wejs et al. (2014) on the key role for institutional entrepreneurs and Bulkeley and Betsill (2013) on the framing of climate change within wider urban agendas. These researchers highlight important stimuli for climate adaptation, but independently these stimuli might not be sufficient for organizing a response. The Philadelphia case illustrates that climate adaptation responses are not organized in a vacuum. One institutional entrepreneur will not hold all capabilities or tools necessary to organize a climate adaptation response and a political leader might not be triggered to act upon climate adaptation without elections. The organization of (municipal) responses to climate adaptation is a process in which several stimuli bring the process forward (or barriers hold the process back).

In addition to this, the Philadelphia case shows that to some extent the combination of stimuli influences the governance approach. Moreover the case shows that the two programs have been triggered by different (combinations of) stimuli which resulted in two different governance approaches on different levels in the municipality (see table 7). The combination of stimuli of elections, societal pressure, political leadership and power resulted in the instalment of a special office by the mayor and the use of metrics to force policy departments to act upon climate change. It initiated a top-down and overall dedicated approach. The other combination of stimuli consisting of regulations in combination with limited resources, collective entrepreneurship, networking and advocacy resulted in program that focused on changing established routines (from grey infrastructure to green stormwater infrastructure) within policy departments. Through pilot projects, learning and legitimacy building for new routines is initiated. The focus is on improving performance concerning climate adaptation through changing existing structures which is in line with the mainstreaming approach.

Table 7: Differences between the municipal responses in the Philadelphia case

Although these are generally presented as two distinct governance approaches, the stimuli identified in the Philadelphia case have led to a governance approach in which the dedicated and mainstreaming approaches co-exist. To some extent, the two approaches even influence each other: the mayor's dedicated program influences the mainstreaming of the water department as the department's responses have to comply with the mayor's metrics. Some researchers have argued earlier that both governance approaches need to be present for the organization of climate adaptation responses (Bulkeley 2010; Carmin et al. 2012). A dedicated approach is necessary to allocate new resources and provide political pressure to speed up responses, while the mainstreaming approach focuses on combining objectives within and between policy departments (legitimacy building) and on developing learning processes in order to structurally change routines. The Philadelphia case illustrates that this is possible, but further (longitudinal) research is necessary to explore how these approaches interact. For each approach, the aim is to organize climate adaptation responses, but these responses might not be the same as one focuses on political profiling and the other on a change in routines. Yet as the governance approaches seem to occur on different levels in the municipal organization, they could also be each other's stimulus to organize climate adaptation responses.

We are aware that our research is based on just one case study and that this is not sufficient for generalization regarding stimuli or governance approaches. Nonetheless, the Philadelphia case provides new insights regarding stimuli and their influence on governance approaches as the stimuli have been identified in a larger context and not just presented as independent stimuli. We encourage other researchers to do this also in other cases as this assists in refining our understanding of possible stimuli for climate adaptation responses.

NOTES

1. Each interviewee has received an abbreviation that relates to their policy department and a number: MOS = Mayor's Office of Sustainability, PWD = Philadelphia Water Department. See appendix 1 to see the list of interviewees and their abbreviation.
2. A greened acre is an acre in which the first inch of runoff is managed by stormwater infrastructure before it heads towards the combined sewer system. Both the area of the stormwater management feature itself and the area that drains to it, is considered part of the green acre (PWD 2012).

REFERENCES

Amundsen, H., Berglund, F., and Westskogô, H. (2010), Overcoming barriers to climate change adaptationöa question of multilevel governance?, *Environment and Planning C: Government and Policy*, Vol.28, pp.276-289.

Aston, A. (2012), Philly mayor Michael Nutter puts his city on a greener path. *Corporate knights*, issue 39. Available at: http://www.corporateknights.com/article/philly-mayor-michael-nutter-puts-his-city-greener-path

Bassett, E. and Shandas, V. (2010), Innovation and climate action planning: Perspectives from municipal plans, *Journal of the American Planning Association*, Vol.76, No.4, pp.435-450.

Betsill, M. and Rabe, B. (2009), Climate change and multilevel governance: The evolving state and local roles. In: D.A. Mazmanian, M.E. Kraft (eds), *Toward sustainable communities: Transition and transformations in environmental policy.* MIT press, pp.201-225.

Biesbroek, G., Termeer, K., Kabat, P. and Klostermann, J. (2009), *Institutional governance barriers for the development and implementation of climate adaptation strategies,* Working paper for the International Human Dimensions Programme (IHDP) conference "Earth System Governance: People, Places, and the Planet", December 2-4, Amsterdam, The Netherlands.

Bulkeley, H. (2010) Cities and the Governing of Climate Change, *Annual Review of Environment and Resources*, Vol.35, pp.229-253.

Bulkeley, H. and Betsill, M. (2013), Revisiting the urban politics of climate change, *Environmental Politics*, Vol.22, No.1, pp.136-154.

Bulkeley, H. (2013), *Cities and climate change*, London: Routledge.

Bulkeley, H. and Tuts, R. (2013), Understanding urban vulnerability, adaptation and resilience in the context of climate change, *Local Environment*, Vol.18, No.6, pp.646-662.

Carmin, J., Anguelovski, I. and Roberts, D. (2012), Urban climate adaptation in the Global South planning in an emerging policy domain, *Journal of Planning Education and Research*, Vol.32, No.1, pp.18-32.

Castán Broto, V. and Bulkeley, H. (2013), A survey of urban climate change experiments in 100 cities, *Global Environmental Change*, Vol.23, No.1, pp.92-102.

Channel DEESTUARY (2011), 'Chris Crockett on Philadelphia's Green City Clean Waters program', April 25th 2011, you tube video, available at: http://youtu.be/T6BWrJnclNo

Dannevig, H., Hovelsrud, G.K. and Husabø, I.A. (2013), Driving the agenda for climate change adaptation in Norwegian municipalities, *Environment and Planning C: Government and Policy*, Vol.31, No.3, pp.490-505.

Edwards, (2013), City Case Study: Adapting to climate change in Philadelphia. In: Bulkeley, H., *Cities and climate change*, London: Routledge, pp.154-158.

Entman, R.M. (1993), Framing: Toward clarification of a fractured paradigm. *Journal of Communication*, Vol.43, No.4, pp.51-58.

Flyvbjerg, B. (2006), Five misunderstandings about case-study research, *Qualitative inquiry*, Vol.12, No.2, pp.219-245.

Focht, M.A. (2013), *Green City, Clean Waters. Green Infrastructure – The Philadelphia Story*, Powerpoint presentation, Philadelphia Parks & Recreation, available at: http://aslathedirt.files.wordpress.com/2013/12/dupontsummit-asla-120613_final.pdf

Fünfgeld, H. and McEvoy, D. (2011), *Framing climate change adaptation in policy and practice*, Climate change adaptation program, Global Cities Institute, Melbourne, available at: http://www.climateaccess.org/sites/default/files/Funfgeld_Framing%20Climate%20Adaptation%20in%20Policy%20and%20Practice.pdf

Gartland, L.M. (2008), *Heat islands: understanding and mitigating heat in urban areas*, London: Earthscan.

IPCC (2007), *Climate Change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge.

Kalkstein, L.S., Jamason, P.F., Greene, J.S., Libby, J. and Robinson L. (1996), The Philadelphia hot weather-health watch/warning system: development and application, summer 1995, *Bulletin of the American Meteorological Society*, Vol.77, pp.1519–1528.

Kern, K. and Alber, G. (2008), *Governing climate change in cities: modes of urban climate governance in multi-level systems*, proceedings of the OECD conference on 'Competitive cities and climate change', OECD, Paris.

Kingdon, J.W. (2002), *Agendas, Alternatives, and Public Policies*, New York: Harper Collins College.

Kok, M.T.J., and De Coninck, H.C. (2007), Widening the scope of policies to address climate change: directions for mainstreaming, *Environmental science & policy*, Vol.10, No.7, pp.587-599.

Madsen, H.M., Brown, R., Elle, M. and Mikkelsen, P.S., (2013), A comparative socio-technical discourse analysis of Water Sensitive Urban Design for Melbourne, Australia and Copenhagen, Denmark. In: *8th International Water Senitive Urban Design Conference 2013* (p. 1).

Maimone, M., O'Rourke, D.E., Knighton, J.O. and Thomas, C.P. (2011), Potential impacts of extensive stormwater infiltration in Philadelphia, *Environmental Engineer: Applied Research and Practice*, Vol.14, pp.1-12.

Maimone, M. (2013), *CSO Control: a Green Approach. Philadelphia's Green City Clean Waters Program*, Powerpoint presentation, CDM Smith, Philadelphia.

Mayor's office of Sustainability, (2012), Greenworks Philadelphia 2012 progress report, City of Philadelphia.

Mayor's office of Sustainability (2013),Greenworks Philadelphia 2013 progress report, City of Philadelphia.

Meijerink, S. and Huitema, D., (2010), Policy Entrepreneurs and Change Strategies: Lessons from Sixteen Case Studies of Water Transitions around the Globe, *Ecology & Society*, Vol.15, No.2.

Moser, S.C. and Ekstrom, J.A. (2010), A framework to diagnose barriers to climate change adaptation, *Proceedings of the National Academy of Sciences*, Vol.107, No.51, pp.22026-22031.

Next Great City, (2014) Next Great City. Available at: http://www.nextgreatcity.com/

Pralle, S.B., (2009), Agenda-setting and climate change. *Environmental Politics*, Vol.18, No.5, pp.781-799.

PWD, no year, *Green guide for property management, Green City Clean Waters: Green Business Program*, Philadelphia Water Department, Philadelphia.

PWD, (2009), *Philadelphia Combined Sewer Overflow Long Term Control Plan Update*, September 2009, Philadelphia Water Department, Philadelphia.

PWD, (2011), *Green City, Clean Waters. The City of Philadelphia's Program for Combined Sewer Overflow Control*, June 11th 2011, Philadelphia Water Department, Philadelphia.

PWD, (2012), *Green City, Clean Waters Comprehensive Monitoring Plan*, December 1st 2012, Philadelphia Water Department, Philadelphia.

PWD, (2014), *Philadelphia Water Department: what we're doing*, Philadelphia Water Department, Philadelphia, available at: http://www.phillywatersheds.org/what_were_doing/documents_and_data/cso_long_term_control_plan

Rosenzweig, C., Solecki, W., Hammer, S. and Mehrotra, S., (2010), Cities lead the way in climate-change action, *Nature*, Vol.467, No.7318, pp.909-911.

Runhaar, H., Mees, H., Wardekker, A., Sluijs, J. van der, and Driessen, P.P.J., (2012), Adaptation to climate change-related risks in Dutch urban areas: stimuli and weaknesses, *Regional Environmental Change*, Vol.12, No.4, pp.777-790.

Smith, J.B., Vogel, J.M. and Cromwell III, J.E., (2009), An architecture for government action on adaptation to climate change, an editorial comment, *Climatic Change*, Vol.95, pp.53-61.

Sippel, M. and Jenssen, T., (2009), What about local governance? A review of promise and problems, *MPRA Paper No. 20987*.

Termeer, C. (2009), Barriers to new modes of horizontal governance: A sense-making perspective, *Public Management Review*, Vol.11, No.3, pp.299-316.

Tompkins, E.L., Adger, W.N., Boyd, E., Nicholson-Cole, S., Weatherhead, K. and Arnell, N., (2010), Observed adaptation to climate change: UK evidence of transition to a well-adapting society, *Global environmental change*, Vol.20, No.4, pp.627-635.

Uittenbroek, C.J., Janssen-Jansen, L.B. and Runhaar, H.A.C. (2013), Mainstreaming climate adaptation into urban planning: overcoming weaknesses, seizing opportunities and evaluating the results in two Dutch case studies, *Regional Environmental Change*, Vol.13, No.2.

Uittenbroek, C.J., Janssen-Jansen, L.B., Spit, T.J.M., Salet, W.G.M. and Runhaar H.A.C., (2014), The role of political commitment in organizing municipal responses to climate adaptation: the dedicated approach versus the mainstreaming approach, *Environmental Politics*, in press.

Wejs, A., Harvold, K., Larsen, S.V. and Saglie, I.L., (2014), Legitimacy Building under Weak Institutional Settings: Climate Change Adaptation at the Local Level in Denmark and Norway, *Environmental Politics*, Vol. 23, No. 3, pp. 490-508.

APPENDIX 1: OVERVIEW OF INTERVIEWEES

Abbreviation	Name / Position	Date of interview
MOS01	Policy and Outreach Manager, City of Philadelphia Mayor's office of Sustainability	December 2nd, 2013
MOS02	Former policy director of sustainability, City of Philadelphia	December 4th, 2013
PWD01	Deput Commisioner Planning & Environmental Services, Philadelphia Water Department	December 3rd, 2013
PWD02	Manager, Green Infrastructure Planning, Philadelphia Water Department	December 3rd, 2013
PWD03	Chief of Staff, Philadelphia Water Department	December 3rd, 2013
PWD04	Director of the office of watersheds, Philadelphia Water Department	December 3rd, 2013
PWD05	Public manager, Philadelphia Water Department	December 6th, 2013
PWD06	Source Water Protection manager, Philadelphia Water Department	December 6th, 2013
PWD07	Strategic planner, Office of Watersheds, Philadelphia Water Department	E-mail
PWD08	Consultant, Green City Clean Waters, CDM Smith	December 6th, 2013
PWD09	Consultant, Source Water Protection, CDM Smith	December 6th, 2013
PWD10	Planner / Associate, WRT Design	December 3rd, 2013
CP01	Deputy Executive Director, Philadelphia City Planning Commission	December 4th, 2013
CP02	Senior planner, Philadelphia City Planning Commission	December 4th, 2013
CP03	First Deputy Commissioner, Philadelphia Parks and Recreation	E-mail
CP04	Environmental Health Program Administrator, Philadelphia Public Health	December 4th, 2013
CP05	Director and Professor, Center for Sustainable Communities, Temple University	December 2nd, 2013

MOS = Mayor's office of Sustainability, PWD = Philadelphia Water Department, CP = other City of Philadelphia departments

FIGURES

Photo 1 Kensington High School manages all stormwater on site using green roofs, rain gardens and more. (Focht 2013)

Photo 2 Stormwater planters at Columbus Square Park maintained by the neighborhood community. (PWD 2014)

TABLES

Table 1 The dedicated approach and the mainstreaming approach

	The dedicated approach	**The mainstreaming approach**
Agenda-setting	Political agenda	Policy department agenda
Framing	Main objective (explicit)	Added value (implicit)
Resources	New resources (specific bureau)	Existing resources
Policy design	Special policy	Synergies in policy objectives
Implementation	Conformance	Performance

Source: Based on Uittenbroek *et al.* 2014

Table 2 Ten action steps of the Next Great City coalition

1. Create Public Riverfronts
2. Expand recycling
3. Improve transit stops
4. Stop sewer backups & flooding
5. Adopt Modern Zoning
6. Use Clean Energy & Construct Energy Efficient Buildings
7. Replant Neighborhood Trees
8. Maintain Healthy Parks
9. Clean & Green Vacant lots
10. Reduce Asthma Caused by Soot

Source: Next Great City 2014

Table 3 Greenworks – goals, targets and initiatives

Goals	**Targets**	**No. of initiatives**
Energy	1. Lower city government energy consumption by 30 percent 2. Reduce citywide building energy consumption by 10 percent 3. Retrofit 15 percent of housing stock with insulation, air sealing and cool roofs 4. Purchase and generate 20 percent of electricity used in Philadelphia from alternative energy sources	57
Environment	5. Reduce Greenhouse Gas Emissions 6. Improve Air Quality toward attainment of Federal Standards 7. Divert 70 percent of Solid Waste From Landfill	32
Equity	8. Manage Storm water to Meet Federal Standards 9. Provide walkable access to park and recreation resources for all Philadelphians 10. Provide walkable access to affordable, healthy food for all Philadelphians 11. Increase tree coverage toward 30 percent in all neighborhoods by 2025	44
Economy	12. Reduce vehicle miles traveled by 10 percent 13. Increase the state of good repair in resilient infrastructure 14. Increase the size of the regional clean economy	28
Engagement	15. Philadelphians unite to build a sustainable future	5

Source: Mayor's Office of Sustainability 2013

Table 4 Stimuli for Greenworks

Who	*People*	Next Great City coalition, political leadership
When	*Momentum*	Elections, societal pressure
Why	*Framing*	Sustainability in relation to energy, environment, equity, economy and engagement
How	*Capabilities/Tools*	Political pressure, special bureau for sustainability (human resources), metrics

Table 5 Economic, social and environmental benefits of GSI

Economic	**Social**	**Environmental**
Property values	Recreation	Fishable, swimmable water
Job creation	Aesthetics	Habitat enhancement
City competitiveness	Public Health	Air quality
	Equity	Energy savings
		Carbon footprint

Source: Focht 2013

Table 6 Stimuli for Green City Clean Waters

When	*Momentum*	Regulations, financial limitations
Who	*People*	Collective entrepreneurship within water department
Why	*Framing*	Societal, economic and environmental benefits
How	*Capabilities/ Tools*	Financial resources, networking through advocacy and brokerage, perseverance, flexibility

Table 7 Differences between the municipal responses in the Philadelphia case

Municipal program	**Greenworks**	**Green City Clean Waters**
Initiator within municipal organization	Mayor (political agenda)	Policy department (policy agenda)
Stimuli	i.a. elections, societal pressure, political leadership and power, metrics	i.a. regulations, collective entrepreneurship, networking, advocacy
Governance approach	Dedicated approach	Mainstreaming approach