



Climate Proofing Urban Water Management

Sustainable Mitigation-Adaption Approaches of Urban Fresh Water Management to Climate Change

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Abstract

This thesis studies reactions in urban water management to climate change and its' impacts. The research focused on barriers and success factors to the emergence and realization of climate relevant urban planning policies in cities. Case studies were employed to validate and prioritize the barriers and success factors identified from policies and scientific publications. Individual strategies and success factors, as well as common, more general applicable strategies could be extracted from the case studies. Hopefully this study will prove helpful in the practical application of strategies to overcome the barriers to climate proofing urban planning.

Declaration of Authorship

Hereby I declare, that I conducted this thesis independently and that I did not use any references or aid, apart from the stated references. Furthermore I declare to have followed the principles to scientific research and publication, as stated in the guideline on good scientific practice from the University of Oldenburg.

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1. Introduction

1.1 Introduction

Currently urban planning is preoccupied with developing adequate responses to challenges rising from global socio-economic trends that interact with climate change.

Forecasts suggest that the ongoing urbanization trend will continue (IPCC 2007). Already today half of the world's population lives in cities. Until 2050 an estimated 75 % of the world's inhabitants will live in urban agglomerations. The trend of an increasing urbanization is also linked to a continuous growth of the world's population. These socio-economic trends result in an increasing demand and competition for water. At the same time urbanization also reduces the area available for natural flood management or increases the number of homes and businesses actually in flood-prone areas' (EEA 2012, p. 6). This increases the pressure on urban planning, existing infrastructure and available resources. The resource issue is further fuelled by the depletion of fossile fuels. For example in Sweden resource dependency and its geopolitical implications became an issue following the 1970 oil crisis, the United States invaded Iraq in 2003 to secure vast oil fields and currently resource dependency from Russian gas has gained a lot of attention, due to the conflict on the Krim peninsula, and is used as a geopolitical instrument.

At the same time the impact of the climate change is becoming more noticeable. Changes in the average temperature and the increase of GHG in the atmosphere caused profound changes in the water column of all oceans. This affects the global water cycle. Currently we experience a transport of water from the equator to the pole regions. Heating of the ocean and the increased uptake of melt water lead to a rise of the sea level. Currently the



Fig. 1 Flooding in Rotterdam 2006 (from Jacobs et al. 2007, pp. 54-55)

global average for rise of the sea level is estimated to be 1.7 mm per year (IPCC 2007). At the same time we observed changes on land as well. Over the last decades glaciers melted down considerably, rain-fall patterns change throughout the year and melting perma frost areas destabilize. The occurrence of natural disasters increases and threatens the human water supply and safety (Fig. 1).

The combination of climate change related changes and the global socio-economic trends discussed above pose a great challenge to spatial planners. In the face of the described threats planners had to react to the changing environmental circumstances. In the urban development context this translated into climate policy development. In general climate policies approach climate change in two ways: mitigation and adaptation.

Definition climate mitigation

Climate mitigation includes all actions taken to reduce or solve the vulnerability to and the long-term risks from climate change to human societies. More specifically the International Panel on Climate Change (IPCC) defined mitigation as 'An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases.' (Parry et al. 2007).

Coherent with the focus of the IPCC's mitigation definition on GHG reductions, most efforts on mitigation were limited to the mitigation of GHG emissions (Schipper 2010).

Definition climate adaptation

The term *adaptation* was first coined in evolutionary biology and then applied by anthropologists and cultural ecologists to human systems. Denevan (1983, p. 401) thus defines it as 'process of change in response to a change in the physical environment or change in the internal stimuli, such as demography, economics and organization'. In the climate change literature adaptation is for example referred to as 'the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.' (Parry et al. 2007). The concepts of adaptation, adaptive capacity, vulnerability, resilience, exposure and sensitivity are interrelated. All of these concepts can be applied on different spatial and temporal scales, e.g. instantaneous (spring floods) or over centuries (sea level rise). Consistent throughout the literature is the notion that the vulnerability is reflecting the exposure and sensitivity of that system to hazards and its capacity or resilience to cope, adapt or recover (Smit and Wandel 2006, p. 286).

In the early stages of climate policy development scientists and politicians were focused on the mitigation of greenhouse-gas emissions (Schipper 2006). A number of academics (see below) advocated that in terms of a sustainable urban development a transition should be made from linear to circular systems of production and consumption, so called metabolic flows. This notion brought forth concepts such as circular urban metabolism (Girardet 1996), cities as sustainable ecosystems (Newman and Jennings 2008), urban symbiosis (Van Berkel et al 2009) or symbiocité (Gontier 2005).

These concepts commonly emphasized that interconnections should be developed between different metabolic material and energy flows in order to improve efficiency and reduce waste. An example for integrating metabolic flows is the use of domestic waste for energy provision

(Vernay et al. 2011) or the extraction of thermal energy from waste water for urban heating as recently proposed for implementation in Munich (Germany) by the Technical University Munich. Several cities and municipalities are applying systems integration (see Joss 2010).

However recognition grew, that mitigation alone would be insufficient to avoid serious climate change impacts, therefore scientists and policy makers recognized that both mitigation and adaptation were needed (Klein et al. 2007). Mitigation and adaptation were seen as two complementary but disconnected approaches to the same problem, mostly ignoring possible synergies (Swart and Raes 2007). Klein et al. (2007) and Biesbroek et al. (2009) labelled this the 'mitigation-adaptation dichotomy'.

A discussion on the potentials of combining both mitigation and adaptation approaches was only brought up around 2007 (Burch and Robinson 2007, Dowlatabadi 2007, Jones et al. 2007). Even the most stringent mitigation efforts cannot avoid further impacts of climate change in the next few decades due to past emissions, which makes adaptation essential, particularly in addressing near-term impacts. Although many early impacts of climate change can be addressed through adaptation, the possibilities for successful adaptation diminish and the associated costs increase in magnitude with increasing climate change (Parry et al. 2007). Thus unmitigated climate change could exceed the capacity of natural, managed and human systems to adapt in the long run. Therefore IPCC's Working Group II to the Fourth Assessment Report on Impacts, Adaptation and Vulnerability of climate change suggested a mix of strategies that include mitigation, adaptation, technological development and research (Parry et al. 2007).

The recognition of the link between mitigation and adaptation has initiated a shift in politicians' and scientists perspective from climate change as the central problem towards a broader transdisciplinary and sustainable development perspective for mitigation and adaptation (Nelson et al. 2007, Robinson et al. 2006, Klein et al. 2007).

This thesis is about urban climate policies and how they can be established for cities and modified water cycles. Success factors and strategies to overcome the intertwined climatic and socio-economic challenges will be studied on two case studies, namely Rotterdam und Stockholm.

1.2 Research objective

Along with the preparation and processing of the UNCED's climate convention in Rio de Janeiro 1992 several organisations dedicated to climate change issues were set up by the United Nations (UN), e.g. the International Council for Local Environmental Initiatives (ICLEI) which has become 'ICLEI - Local Governments for Sustainability' in 2003, the United Nations Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change

(IPCC). However the focus of these currently existing associations is assessing the impacts of climate change (IPCC 2007), whereas the work of UNFCCC and ICLEI is more action oriented and focussed on helping third parties, national governments or cities, with the different steps of the adaptation process, e.g. policy mainstreaming, awareness raising, self-assessments, action plans, funding etc (ICLEI 2007). Sector-specific, more comprehensive guides such as the *Adapting to Coastal Climate Change: A Guidebook for Development Planners* (USAID 2009) included the concepts of complexity of vulnerability and propose the mainstreaming of adaptation, integrating it into all stages of decision-making. So far guides moved from assessing vulnerability through identifying adaptive capacity, designing and implementing adaptation measures to monitoring the success and effectiveness of implementation. 'But, most of this information does not explain how these approaches should be implemented' (Schipper 2010, p. 16). Coherently several other authors came upon barriers (see Fig. 2) to climate policy formulation and implementation. 'Changing the policy paradigm as well as the governance approach is difficult because of institutional path dependency and deep rooted beliefs.' (Ward et al. 2012, p. 15). Although the need to mainstream mitigation and adaptation policies to reduce redundancies and waste of financial and human resources in separate policy formulation for each sector has been recognized (see Ch. 1.1), this has not contributed to integrated and coordinated climate policies (Biesbroek 2009).

Van Nieuwaal et al. (2009) concluded from a review on adaptation governance that the combination of a large number of actors, the high degree of uncertainty on the impacts from climate change and the call for immediate action against long-term visions make adaptation a challenge and blurr the traditional boundaries between public and private sector.

Harrison and Mc Intosh Sundstrom (2007) found costs of climate policies to be the decisive factor in explaining the lack of widespread citywide climate protection activities (see also Ürge-Vorsatz et al. 2007, Dhakal and Betsill 2007). Sippel and Jenssen (2009) point out the damage by a lack of cooperation among stakeholders in climate policymaking, which required co-operation on different levels. Also overcoming the fragmentation in urban governance proves difficult (Mc Carney 2011). This fragmentation is also reflected in the regionally inconsistent use and definition of terminology, which also makes data hard to compare (McCarney 2010).

Also relevant, while local adaptation activities benefit a city directly, the benefits of local mitigation activities are non-excludable. The effects on the global greenhouse effect from local mitigation measures is very small and benefits everyone. Therefore local climate protection underlies the logic of the "Tragedy of the Commons" (Kousky and Schneider 2003), since implementing measures and spending resources is economically not sensible if others do not take measures as well.

An MIT study (Carmin et al. 2012) conducted a global survey among 468 cities, which mostly had already engaged in adaptation efforts, and identified a list of major challenges throughout

the adaptation process. 79% perceived environmental changes attributed to climate change. 68% of the cities report pursuing adaptation efforts (Carmin et al 2012). Although a closer look at the four most common adaptation activities revealed the nascent state of planning initiatives in most of the responding cities. These activities are meeting with local government departments on adaptation, searching the web or literature for information, forming a commission or task force to support adaptation planning and developing partnerships with NGOs, other cities, businesses, or community groups. (Carmin et al 2012).

Adaptation is still difficult as indicated by the most common adaptation activities listed above and furthermore the outcomes of the survey on adaptation identified 19 challenges of which 16 were identified as major issues by at least half of the cities worldwide. ‘Even the lowest ranked item – learning from other communities – is still a major challenge for over 20% of the cities.’ (Carmin et al. 2012, p. 20).

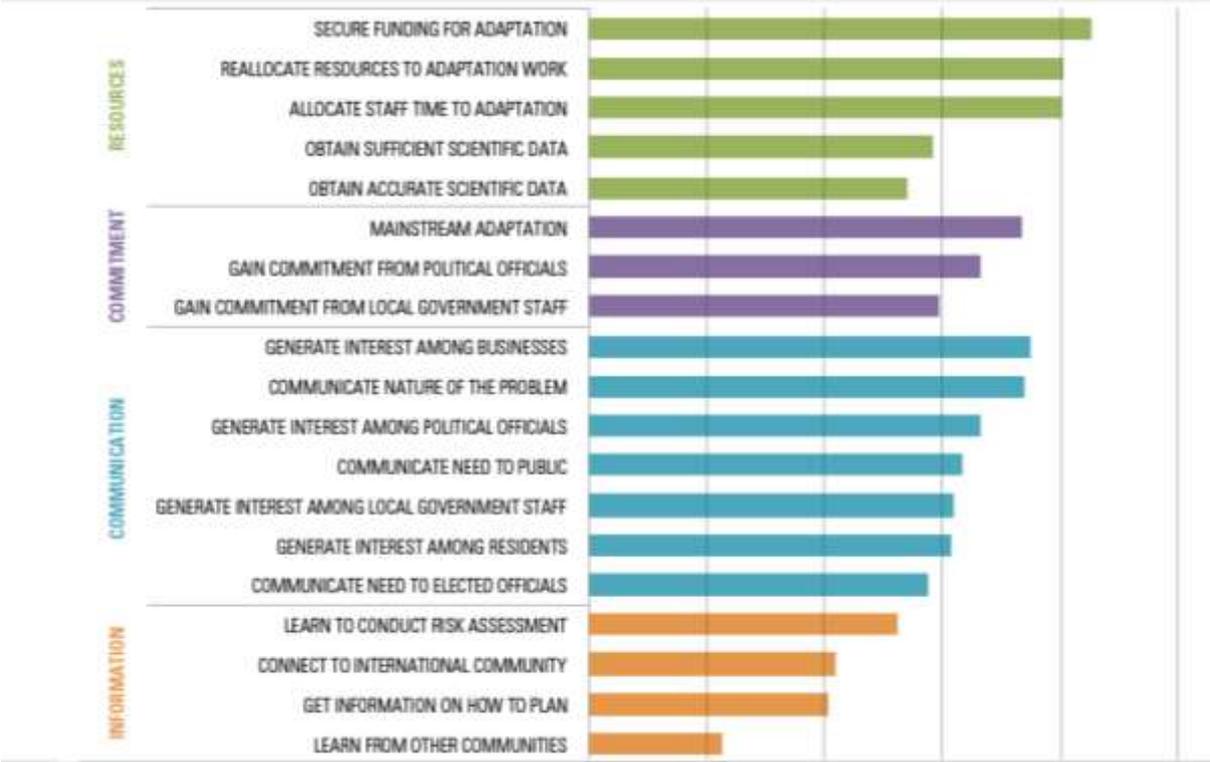


Fig. 2 Global challenges in initiating or advancing urban adaptation (from Carmin et al. 2012, p. 21)

Resource-related challenges were the highest rated overall, since adaptation planning requires funds to support staff time, hire consultants to conduct research, purchase data, and promote outreach. Securing funding for adaptation work was a major challenge for 85% of cities worldwide. 60% were not receiving any support for their adaptation activities. This could also be related to a knowledge gap of the local level on available national and international funding. Gaining commitment (74%) and communicating the importance of pursuing adaptation, especially to elected officials (58%) were ongoing challenges for the majority of cities (Carmin et

al. 2012). Although informational challenges were ranked lowest, the need for data was nevertheless a challenge to over 50% of cities worldwide.

All the articles and studies referred to point out that there are multiple and quite diverse barriers to climate proofing cities, mitigating and adapting to the climate change impacts.

Although there is a growing need for urban planning to respond to climate change (see Ch. 1.1) the studies referred to above confirm that in theory there are strategies to climate proofing cities, whereas the practical application and implementation proves difficult.

Hence this thesis focuses on success factors and strategies to overcome the challenges to effective initiation and implementation of urban climate policies and on the most relevant drivers for this process.

How can cities effectively respond to climate change related modifications of the water cycle?

1.3 Research Questions

Theoretic (general)

As climate change, population growth and resource depletion (see Ch. 1.1) are issues of a more general, long-term nature, urban development in many cities is fragmented between rivalling departments. Local governments often lack the capacities to plan and implement climate concepts. Cooperation with societal and private stakeholders is rocky drafting and establishing an urban climate policy is quite a challenge. Despite direct consequences from natural disasters or a high degree of vulnerability not all affected cities are trying to initiate adaptation. Possibly a combination of different incentives or external involvement is necessary.

(1) Which windows of opportunity can be identified to initiate climate related planning in urban context and which factors needs to be addressed?

To frame the theoretic question international articles on the topic will be reviewed and content analysed to establish a theoretical base of knowledge which in turn will be validated and crosschecked with the results from the case studies primary data (see Ch. 3.2).

Empiric (specific)

Vision building is considered a crucial step in the planning process (Shiplely and Michela 2007). The approach chosen to build the vision could already alter outcome and reception of the vision (Van Dijk 2011).

(2) How can participation and collaborative approach to vision building and policy formulation help to open windows of opportunity and deal with the most pressing issues?

To outline the effects of the collaborative policy drafting semi structured interviews will be conducted with municipal planners, which will be further elaborated by secondary data from policy- and newspaper content analysis.

Synthesized

From the extensive literature on climate planning factors and strategies perceived as essential to the emergence, planning and implementation, as well as major barriers to these efforts became apparent.

(3) Drawing on the review of known barriers to mitigation and adaptation efforts (Ch. 1.2) which factors and strategies were specifically employed to overcome these barriers in the two case studies?

The preliminary set of factors derived from the literature content analysis will be crosschecked, validated and prioritized using the data from the interviews and the newspaper content analysis.

2. Theoretical Framework

The key questions in this paper evolve on the one hand around 'how climate policies emerge, respectively how the idea tackles the initial challenges (Ch. 1.2) and on the other hand 'which particular capabilities allow successful implementation and to what extent they could be generally applied.

For most cities a commitment to climate planning requires adjustments in the institutional frameworks steering the city's development. According to Carmin et al. (2009) there are three sets of factors associated with institutional change in cities that are relevant to adoption of climate planning – namely incentives, ideas and capacities. The first two factors 'incentives' and 'ideas' are often linked to the diffusion and adoption of innovation of climate planning (Dobbin, Simmons and Garrett 2007).

To approach the first question it might be helpful to regard climate policies as an idea and try to understand how ideas are communicated. Although considering climate change in planning is in itself not new, but the majority of the population perceives it as new, therefore it can be defined as an innovation (Rogers 2003, p. 12). The process of adopting innovations has been studied throughout the last decades. The most accepted model has been developed by Rogers in his book 'Diffusion of innovation' (Sahin 2006). Rogers has defined diffusion as 'the process in which an innovation is communicated through certain channels over time among the members of a social system' (Rogers 2003, p. 5). Thus innovation, communication, time and social system are the key elements for the diffusion of innovation. The main obstacle to adopting innovation is uncertainty. This is especially true for something rather distant and uncertain as climate change. To reduce uncertainty Rogers describes the 'innovation-decision process' as 'an information seeking and information processing activity where an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation' (Rogers 2003, p.172). The innovation-decision process comprises of five steps:

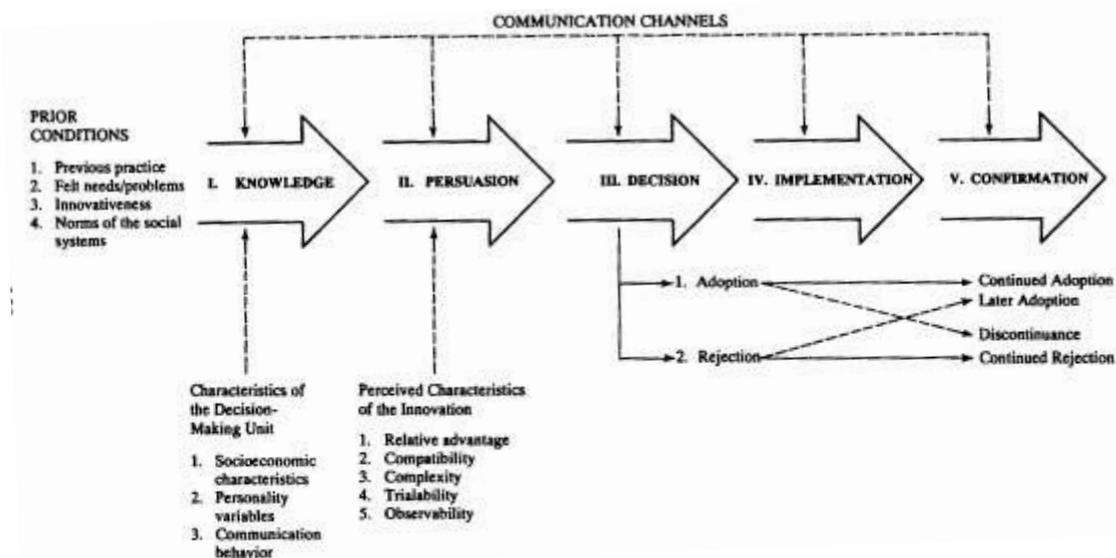


Fig. 3 Model of the stages of the Innovation-Decision Process (from Rogers 2003, p. 163)

The theory of diffusion explains how innovations, e.g. the adaptation to climate change are adopted and thus explains how the adaptation process can be initiated through the diffusion of (international) knowledge, norms and policies. Consequently social scientists have developed four theories to explain the diffusion of policies across countries. *Constructivists* trace policy norms to experts defining economic progress and human rights. *Coercion* theorists point to powerful national and international players that shape international policy through threats and promises. *Competition* theorists find that countries compete for competitive advantages by lowering the costs or reducing barriers. *Learning* theorists suggest that countries learn from their own experiences and from others policy experiments (Dobbin, Simmon, Garrett 2007).

These theories attribute policy diffusion either to changing ideas or to changing incentives. Constructivists and learning theorists agree that changes in ideas lead to changes in policy, whereas competition and most coercion theorists attribute policy changes to shifts in incentives (Dobbin, Simmons, Garrett 2007).

Incentives

Incentives rely on the promise of rewards. Incentives can be broadly grouped into internal and external incentives. Most scholars emphasize how external incentives promote urban change (Carmin et al 2009). External incentives include associated risks from or vulnerability to climate change impacts (see Ch. 1.1), such as heat waves, flooding and scarcity (EEA 2012), as well as global trends, international agreements (e.g. Kyoto protocol) and regulations (e.g. EU directives). The degree of risk from and vulnerability to climate hazards is the decisive determinant.

Internal incentives include improving the city's image, to attract investors or revitalize rundown neighborhoods and brownfield areas (Loftus 2011). Local initiatives by citizens or NGO's, such as the Local Agenda 21, urban gardening projects or the food coop, can raise awareness and support for sustainability -, climate - and urban planning issues or raise quality issues on the urban lifestyle. In the climate arena environmental, development and humanitarian aid organizations have the potential to diffuse ideas and practices among local governments through collaboration, advocacy, protests or policy papers (Boli and Thomas 1999, Carmin et al 2009). Economic reasons like developing exportable technological solutions and expertise or entering a new market can be strong motivations (Molenaar et al. 2009). Pressures from urbanization and population growth (Iverot and Brandt 2011) can pose as incentives to develop a resource and cost efficient urban planning.

Another more geopolitical reason could be to decrease resource related and financial dependencies through demand reduction and increased efficiency.

Ideas

In the climate planning contexts ideas refer to the alteration of behavior through knowledge (Dobbin, Simmons, Garrett 2007). Ideas promote change by transmitting information and norms, both within and across countries. The diffusion of ideas, like best practice, sustainable codes of conduct, innovative policy or technological approaches, generate an awareness for the issue and the currently applied approaches as well as an understanding for appropriate response actions. Channels for transferring ideas and knowledge are for example international networks or umbrella organizations, such as the International Council for Local Environmental Initiatives (ICLEI), or national programs, such as the 'Knowledge for Climate' initiative in the Netherlands.

Another source for generating ideas and knowledge are local innovation, research and development.

Whereas the first and second set of factors are directed towards initiating the mitigation-adaptation process and shaping climate planning the third set of factors is dedicated to 'capacity' as the physical foundation for initiating and sustaining change.

Capacity

The ability to implement adaptation and mitigation measures is limited to the existence of adaptive and mitigative capacity that shape implementation, extent and effectiveness of these measures (Sathaye et al. 2007). Adaptation measures are usually more geographically dispersed and smaller in scale than mitigation measures (Ruth, 2005), therefore adaptive capacities refer to a slightly broader and more general set of capabilities than mitigative capacities. 'Despite these minor differences, however, adaptive and mitigative capacities are driven by similar sets of factors.' (Klein et al. 2007, p. 763). Thus Tompkins and Adger (2005) shaped the term response capacity to describe the ability to manage both the generation of greenhouse gases (mitigation) and the associated consequences (adaptation).

According to Clemens and Cook (1999) local capacities include financial, technological, political and social resources. Various sources stress the importance of *capacity building* for implementing and sustaining adaptation planning, e.g. Fenton and Garcia-Costas 2003, EEA 2012, p. 165-182, Kreft et al. 2011, p. 10-12, Carmin et al. 2009, p. 3-4 and others. Capacity development is defined by the 'United Nations Development Programme' (UNDP) as the process through which individuals, organisations, and societies obtain, strengthen, and maintain the capabilities to set and achieve their own development objectives over time (Wignaraja 2008). Another definition by the World Bank already gives some clues as to which factors are relevant to the *capacity* set of factors: '*Capacity is the proven ability of key actors in a society to achieve socio-economic goals on their own. This is demonstrated through the functional presence of a combination*

of most of the following factors: viable institutions and respective organizations; commitment and vision of leadership; financial and material resources; skilled human resources.' (Farrell 2007). Thus *capacity* includes financial, technological, human, political and social resources (Carmin et al. 2009). Roberts (2008) and Schreurs (2008) additionally emphasize the importance of leadership for promoting innovative ideas and establishing environmental programs.

Following the categorization of Carmin et al. (2009) and based on Rogers (2003) theory of diffusion, that was theoretically developed and transferred to policy diffusion by Dobbin, Simmons and Garrett (2007) elaborating the importance and *incentives* and *ideas* for the emergence phase of an issue, policy formulation and planning. Satahye et al. (2007) found the ability to implement plans and policies to be dependent on the mitigative and adaptive capacity, commonly defined as *response capacity* by Tompkins and Adger (2005).

To conclude three sets of factors related to the research questions (Ch. 1.3) could be identified from the theoretical background: (1) ideas, (2) incentives, (3) capacities. A preliminary list of relevant factors to the case studies will be extracted from the literature review and attached to the following chapter.

3. Method and Methodology

3.1 Method: Case Study

As the research objective is directed towards understanding and extracting essential factors of the adoption of mitigation and adaptation strategies case studies pose an appropriate method to gain an understanding of the process. Although the case study is a comprehensive examination of a single case, it can still 'provide [...] information about the broader class.' (Ruddin 2006). Generalization can prove problematic as qualitative results from case inference are not statistically relevant inferences. Flyvberg (2001) argues therefore that case study research should be employed as a strong way of 'hypothetico-deductive theorizing' instead of perceiving it as an insufficient statistical inference. Flyvberg states that the generalizability can be improved by selecting 'critical cases' to obtain the richest data. 'Critical cases' permit a logical deduction, such as 'If this is valid in the present case study, then it also applies to all (most) other cases (Flyvberg 2006). In short, whereas direct generalizations pose a pitfall for the researcher, he can still deduct theories on the context of the case.

Following these rather theoretical notions on case studies the method applied in this research will rely on the study of critical cases of urban water management adaption processes to identify and validate success factors and strategies that are generally applicable under comparable conditions.

3.1.1 Case Selection

The case selection is essential in case study research. The selection of critical cases was not based on context or comparability, rather they should display diverse features of water management to produce the richest possible data (Flyvberg 1998). Therefore cases for this study were selected based on the 'diverse case method' as described by Seawright and Gerring (2008). The diverse case method describes an exploratory study that seeks to capture maximum variance of the relevant dimensions. Obviously two cases are a minimum requirement for this method. For this study the two cases in Rotterdam and Stockholm were selected to reflect upon the diverse features of urban fresh water management, ranging from conventional mitigation efforts over holistic eco-cycle approaches to the latest adaptation measures on flood protection. All selected cases had to be situated within an urban context and capture the range of variations to increase the representativeness of the selected samples. Furthermore the cases had to be successful examples of climate planning for extracting the essential factors to a successful emergence, planning and implementation of the plans. A limiting factor during the selection was the relatively small amount of available case studies, since the topic was rather new. Due to

financial and temporal constraints all cases had to be within Europe. An additional constraint was the language barrier, since sufficient data and research material had to be available in English. This was rather not the case in Southern Europe.

Finally two quite diverse cases were selected. On the one hand one of the very first sustainable urban development approaches mainly dealing with climate change mitigation from Stockholm, Sweden, that served as a model for urban development worldwide. On the other hand a later example of a highly vulnerable city employing a mixed mitigation-adaptation strategy as suggested in Ch. 1.2 from Rotterdam, the Netherlands, that has developed technological solutions and expertise for international transfer.

The first case selected from Sweden was back in 1996 one of the pioneers of climate mitigation and sustainable urban development. Due to ongoing urbanization and population growth the City of Stockholm decided to develop a new urban district in the southern part of the city. For different reasons it was decided to develop a sustainable, eco-friendly district as pilot for urban development and renewal in the Stockholm area. The development of the eco district internationally set new standards to sustainable urban development and the concept has already inspired other cities worldwide to transfer it. Hammarby Sjöstad was chosen because it was first of a kind and because it set new standards in urban development, urban planning and project management with its holistic planning model and the unprecedented interdepartmental mainstreaming of sustainability into all sectors of urban planning.

The second case study is from Rotterdam, the Netherlands, and was started in 2007. The Netherlands are renowned internationally for their vast experience and expertise on water management. Innovative solutions developed here could be interesting on a global scale. Furthermore Rotterdam is a low-lying delta city, highly vulnerable to and at risk from storm surges, sea level rise, increased extreme precipitation and riverine flooding. The 'Rotterdam Climate Proof' (RCP) concept launched in 2008 rose up to these challenges in a mixed mitigation-adaptation approach. While responding to climate impacts Rotterdam is also creating an export product through scientific research and technological development. This mixed strategy applied is coherent with the IPCC's recommendation (Parry et al. 2007) and proved successful so far. This very much up-to-date mixed approach, its high vulnerability to multiple challenges and the aforementioned Dutch expertise linked with economic gains make Rotterdam a very interesting case study.

The two case studies display the variation of a first holistic mitigation concept based on a broader societal movement against a modern mixed mitigation-adaptation approach that was motivated by a high degree of vulnerability to climate hazards. Both cases developed successful strategies to overcome the numerous challenges (Ch. 1.2) to climate planning and could offer valuable lessons.

3.2 Methodology

Qualitative research is often criticized for lack of reliability and validity (Decrop 1999). To avoid bias and fulfill the qualitative criteria set by Lincoln and Guba (1985), namely credibility, transferability, reliability and confirmability, a triangulation approach was used for this study. Implicitly triangulation means studying an object (issue) from three different perspectives. It was first used by the military and navigation (Decrop 1999). In particular the methodology of data triangulation was applied. Data triangulation makes use of multiple data sources. This study is based on (1) policy documents and scientific articles, (2) newspaper articles (3) interviews collected as *primary* and *secondary data*. The *primary data* was collected by interviews. The *secondary data* consisted of policy documents and scientific publications, as well as newspaper articles.

The primary data was collected through semi-structured expert interviews. This methodology allowed for setting a framework for the interview and validating data previously extracted from secondary source, while allowing new questions to be brought up during the interview drawn from the interviewees' information. The interview guide served a double function throughout the interviews on the one hand it prevented the interviewer from presenting himself as incompetent, on the other hand it served a directive function by excluding unproductive topics (Flick 2006). For each case study one to two interviews were conducted with an expert on the emergence and implementation of the concept. The information gathered from the interviews was analyzed using standard coding techniques and compared with secondary data from documents and newspapers. The interview sessions were recorded and consequently needed to be transcribed for coding and analysis. Verbal and non - verbal behavior was described employing semi interpretive working transcriptions as laid out by Ehlich and Rehbein (1976). The written representation was conducted in standard orthography (Kowall and O'Connell 2004). Only those features of the interviews were transcribed that were actually being analyzed. The secondary data was derived from past studies, formal policy documents and newspaper articles by employing qualitative content analysis. The qualitative content analyses aims at reducing unnecessary information. In accordance with Flick (2006), the texts were summarized and abstracted, and then put in context to or connect with related texts. Then the data could be structured, clustered and abstracted in codes. First categories for analysis were set up. Secondly these were used to design a coding guide. Thirdly the coding guide was applied to code all interviews. This allowed for drafting case overviews. At the last stage the interviews underwent a detailed case interpretation to arrive at new theoretical considerations for the list of factors.

During the literature study a number of factors for adaptation could be identified and assigned to one of the three categories. The preliminary 'mitigation- adaptation check list' from literature study is displayed below:

<u>Incentives</u>	<u>Source</u>
<i>External incentives</i>	
Climate change impacts (changed precipitation patterns, river flooding, water scarcity, drought)	Molenaar, et al. 2009
National and International Legislations	Wiering and Driessen 2001, De la Motte 2005
Exposure	Molenaar, et al. 2009
Vulnerability	UNFCCC 2010
<i>Internal incentives</i>	
Private Initiatives (citizen initiatives, NGO's, Business Partnerships, elections(?))	
Image → technologic leadership	Iverot and Brandt 2011
Design exportable product	IAB 2007
Economic reasons (efficiency, savings, finite nature of resources)	
Population growth	Loftus 2011, Iverot and Brandt 2011
Decrease resource related or financial dependencies through demand reduction and efficient use	
Safety concerns	Parry et al. 2007
Attract investors	Molenaar et al. 2009
Urban redevelopment	Graaf and Brugge 2010
<i>Ideas</i>	
Knowledge readily available	Svane 2005, Vernay et al. 2011
Learning capacity	
Local knowledge, R & D	Parry 2007
External exchange of knowledge	Dobbin, Simmons, Garrett 2007
internal exchange of knowledge (workshops, round tables)	Dobbin, Simmons, Garrett 2007
access to information (best practice, pilot projects, current state of the art)	Dobbin, Simmons, Garrett 2007
<i>Capacity</i>	
political support	Clemens and Cook 1999
available financial resources	Clemens and Cook 1999
Technical capacity (capable contractors, equipment)	
Personal resources (consultants, engineers, experts)	Clemens and Cook 1999
Mitigative/adaptive capacity	Klein et al. 2007
Leadership	Roberts 2008, Schreurs 2008
Implementation / Performance	Barrett 2004
Partnerships and Networks	

Fig. 4 Preliminary list of important factors identified from literature review (by author)

4. Case Studies

4.1 CS1 Rotterdam

Context

Rotterdam is the second biggest city of the Netherlands. It is located in a low lying delta area (Fig. 5). Any breaches in primary or secondary defense lines here would have devastating consequences for the hinterland and the areas downstream. Uncertainty of future development and climate change related issues such as changing precipitation patterns constitute the framework of the adaptation process.



Fig. 5 Aerial view of Rotterdam (from Jacobs et al. 2007, pp. 38-39)

In the Rotterdam case a mixture of different incentives has successively led towards an adaptation to climate change. European and national legislations, national policies and a growing awareness caused by extreme weather situations have resulted in a proactive adaptation approach. Though narrowly avoiding inundation during the Meuse river floods of 1993 and 1995, record rainfall in August 2006 resulted in a flooding of the city (Fig. 1). This led to an increased awareness of Rotterdam's vulnerability. (Ward et al. 2012)

The 1993 and 1995 Meuse floods nationally triggered a turn towards more integrated and interactive policy making (Wiering and Driessen 2001, p. 284). Despite initial technical responses aimed at dike reinforcement, the Room for the River policy was the starting point of a new policy line that considered spatial planning as key to water management (Wolsink 2006). Furthermore assessment reports and forecasts (IPCC 2001, IPCC 2007, van den Brink et al. 2003) have been readily available and widely discussed among experts, politics and the media. This raised awareness to the issue at hand.

Although Rotterdam has traditionally been protected by structural measures various strategic policy documents support the interlinkage of water management and spatial planning policies (Woltjer and Al 2007). Thus recently projects to create flood proof areas within the city have

started. This shows a fundamental change in perspective from the exclusive reliance on dykes to preparing for unknown situations or weather events that could breach or overcome the dyke line.

In line with these notions the Water Plan I for Rotterdam (2000-2005) encouraged and stimulated an improved collaboration between stakeholders to secure the plans implementation. The follow up, the Water Plan 2 Rotterdam (2007- 2035) goes even beyond and aims to integrate issues and capacities of water management, urban redevelopment, economic development of leading edge technology (e.g. the floating structures for the Havenstad) and expertise as export product (Jacobs et al. 2007).

The International Advisory Board (IAB) advised the Rotterdam administration to position Rotterdam as a leading water knowledge and climate city in its 2007 report, to 'become a key player in climate adaptation and water knowledge city' (IAB 2007). In 2006 Rotterdam's mayor met Bill Clinton and was invited to the Clinton Climate Conference in 2007 in New York. Since meeting Mr. Clinton the mayor embraced the IAB's recommendations. In February 2008, the IAB recommendation was adopted and the City of Rotterdam commissioned the elaboration of this recommendation into a programme which was the basis for the RCP programme. Together with the DCMR Environmental protection agency, Deltalinqs and the Port Authority, the municipality developed a plan to put the IAB advise into action. This plan was then used to create the Rotterdam Climate Initiative (RCI) in 2007 to coordinate and steer the planning and implementation. The RCI is a collaboration of the Port of Rotterdam, the City of Rotterdam, Deltalinqs and the DCMR environment protection agency.

Approach

In February 2008 the RCI presented the Rotterdam Climate Proof (RCP) programme (Molenaar 2009). The RCP is a program to mitigate and adapt the city to climate change and redevelop critical urban areas. Coherently with the goals of the CCI the RCP addressed climate change issues through integrating businesses and industry as profiteers and drivers to developing globally applicable solutions. This resulted in a close public-private stakeholder relation.

In May 2008, the instruction was further specified by the request for a specific work plan which led to the 2009 adaptation programme 'Rotterdam Climate Adaptation Strategy'. Main objectives underlying the proactive adaptive RCP adaptation program are to secure protection and accessibility of city and port, consequently enhance the attractiveness of the city and become 'one of the world's leading innovative knowledge cities' (Molenaar 2009, p. 5). To achieve this the program is based on three mutually reinforcing pillars - knowledge, actions and marketing communication (Fig. 6). Innovation, knowledge development, research and cooperation and the pooling of know how are central to the 'knowledge pillar'.

Actions consist of the implementation of physical measures, such as developing extra surface water areas or climate-change-adjusted buildings. Of particular interest are here the Stadshavens. As they are located outside of the levees they will be constructed as floating buildings. This project is expected to trigger and accelerate the development of floating structures on a global scale (leading edge technology).

The third pillar marketing communication refers to branding the city as a technology leader and developing international export products. Staying within this line of thought five theme clusters were identified and are to be developed for implementation in Rotterdam as well as international export (Molenaar 2009).

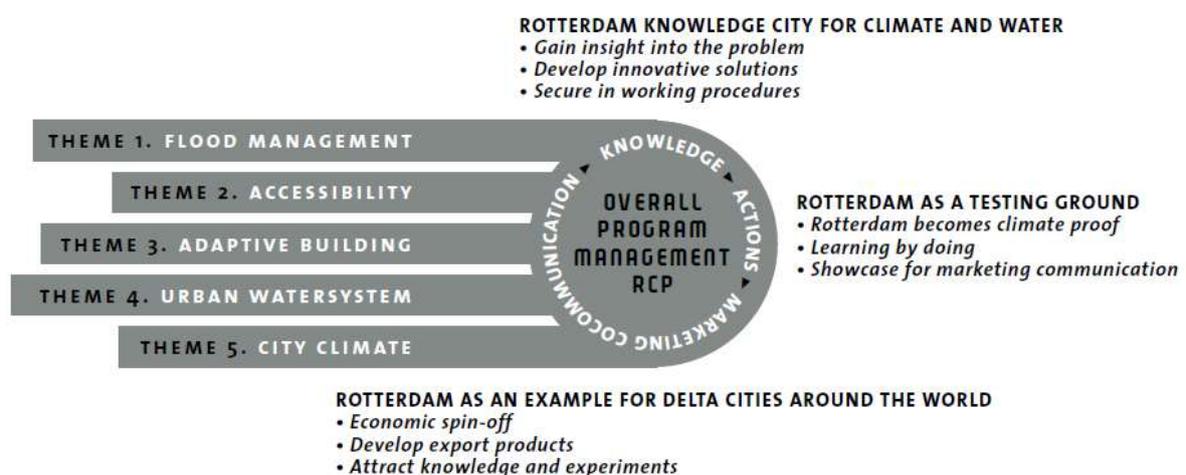


Fig. 6 Rotterdam Climate Proof theme clusters (Molenaar et al. 2009, p. 10)

The five clusters are flood management, accessibility, adaptive building, urban water system and city climate. The Rotterdam approach thus integrates water management, climate change related, as well as spatial planning and economic tasks.

Results

Over the last one and a half decades Rotterdam's water management has shifted from a technological focus on flood protection structures towards a progressive coalition of the local government, regional water boards and other local, scientific and private actors, that mainstream adaptation with other urban challenges. But there are difficulties aligning these urban adaptation strategies with national and regional policies (Ward et al. 2012). Several policies and programs regarding urban water management have been developed, e.g. Rotterdam Water Plan 2, Urban Water Plan 2035, Transformation City Harbors 2040 and the RCP program.

There are several examples and pilot projects for mainstreaming water challenges into urban planning, e.g. or 'waterplazas' or the retention and reduction of excess rain water through green roofs and roof parks. Still those are demonstration projects and implementation on a broader scale is yet to come. The RCP originally targeted the realization of, 800,000 m³ of water storage by developing



Fig. 7 Temporary excess water in underground car parks (from waterworld.com online)

extra surface water areas (Fig. 7), and the implementation of innovative solutions such as water plazas and green roofs until 2025. According to schedule by 2015, 80% of these plans should have been completed (Molenaar et al. 2009). This will probably not be the case as in the current stage innovative pilot projects are realized, but not implementation on a citywide scale.



Fig. 8 Floating pavilions in Rotterdam (from Climate Initiative online)

according to Ward et al (2012) thanks to the RCI offering a multilevel platform from citizen to government. It's website shows more than 200 climate related initiatives from society, public and private sector.

Similarly the approach to climate change mitigation developed. In 2006 Carbon Capture and Storage (CCS) activities started and until today more than 18 major companies cooperated to provide feasibility level engineering studies for CO₂ capture project and a CCS infrastructure network. In 2015 a demonstration phase will start capturing and storing 2.5Mt of CO₂ per year. When successful this phase will be upscaled to a commercial phase until 2025 (van Engelenburg and Noothout 2012).

4.2 CS2 Stockholm (Hammarby Sjöstad)

Context

Stockholm, Sweden's capital where water accounts for approximately 30 % of the cities' surface. For this reason it is sometimes referred to as the 'Venice of the North'. It is built on 14 islands, and includes several lakes and waterways. Given its growing population Stockholm also had to make efforts to attain and preserve those environmental qualities.

Its main problems in terms of water management are eutrophication, due to high phosphorus loads from diffuse sources, historical deposits and the presence of hazardous substances in ground and surface waters. Stockholm has made advances on sustainable urban development and a circular urban metabolism approach. It aims to become fossil fuel free by 2050. (Loftus 2011)

The area under study is a new urban district in the South of Stockholm (Fig. 9). It is called Hammarby Sjöstad, literally 'city at the lake'.

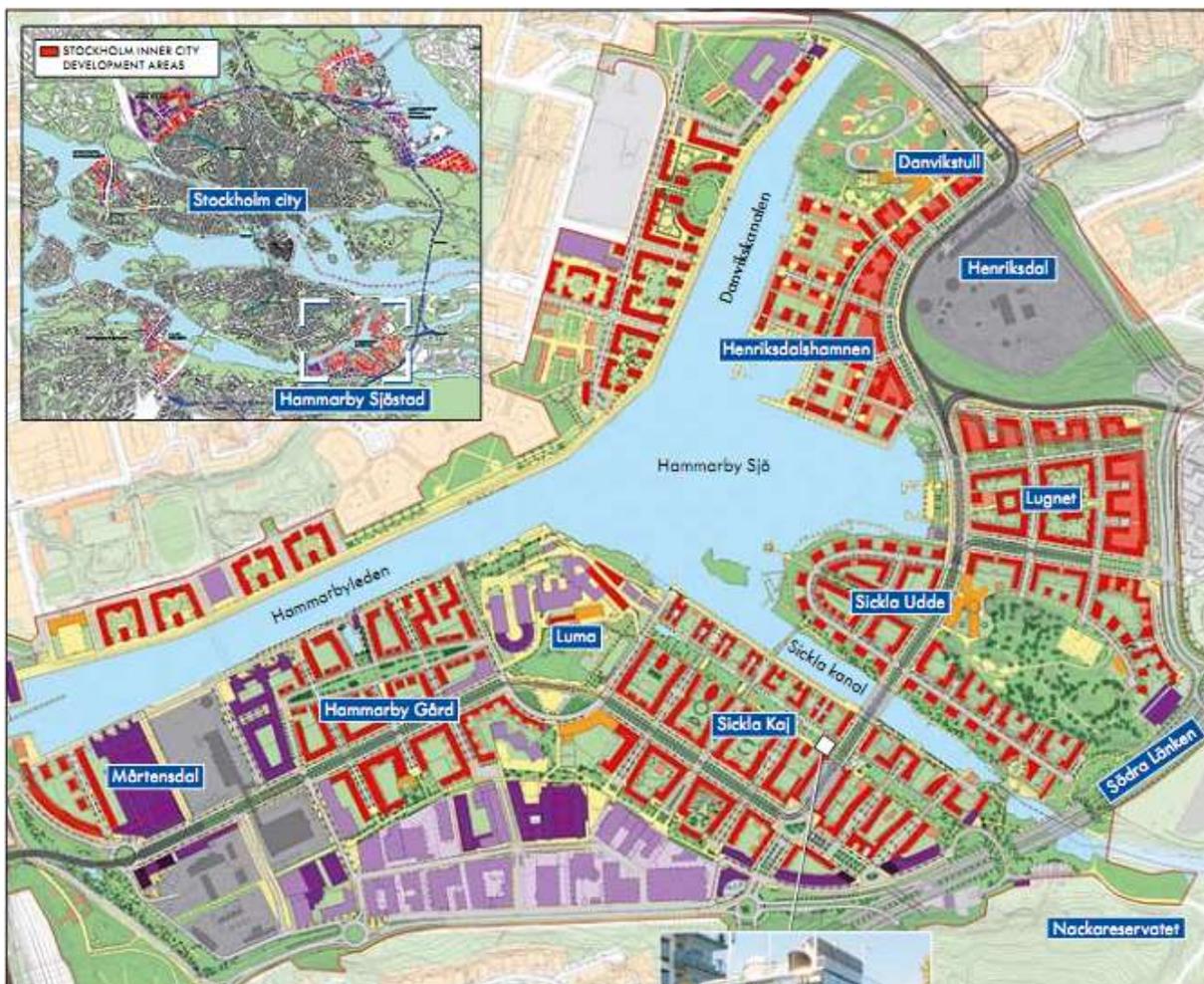


Fig. 9 Development map of Hammarby Sjöstad (from GlashusEtt 2011, p. 8)

The area around Lake Hammarby is a natural continuation of Stockholm's inner city. To account for the growth without jeopardizing environmental sustainability or increasing urban sprawl the city developed the contaminated brownfield area in a sustainable, eco-friendly way.

In the 1880's the area was a popular day trip destination and was referred to as 'Eastern Söder's Pearl' (GlashusEtt 2007). This changed with the industrial development and plans to develop a new harbor area. In 1914 Hammarby Lake was connected to the Baltic Sea via an artificial canal. In 1917 the city of Stockholm bought the land and opened it up for industrial activities. But the plans to build a port area came to nothing and small and large scale industrial activities emerged side by side. In the peninsula of Sickla Udde informal, to some extent semi-legal respectively illegal, small-scale activities developed. Ground and water in this area became heavily polluted by toxic substances (Vestbro 2005).

Although the industrial firms and the harbor were functioning fairly well noise, heavy car traffic and rapid economic changes were considered problematic. Due to the proximity to the city centre the area was also well suited for residential use. In the beginning of the 1990's first plans started to be worked out. Plans for the area got even more serious with the increased demand for housing following the economic boom in 1992 (Vestbro 2005). By 2017 it shall accommodate 35000 inhabitants (Loftus 2011).

Approach

In the mid-1990s Stockholms politicians were very interested to host the 2004 Olympic Games. Inspired by the UN Brundtland Report (World Commission on Environment and Development 1987), the Local Agenda 21 and the call for environmental focus on the applications by the International Olympic Committee, the local leading policymakers in Stockholm wanted Hammarby Sjöstad (Olympic Village) to become a sustainable urban district. To achieve this Stockholm took inspiration from the Sydney 2000 Olympics, which aimed to reduce the metabolic flows of the district. (Iverot and Brandt 2011).

When in 1995 the principal decision was taken to transform the area the City of Stockholm was governed by a red-green coalition, a fact that contributed substantially to the high environmental ambitions of the program. The environmental program was adopted by the City Council in 1996 (www.stockholm.se/hammarbysjostad,[.11.2013]). The active participation of the major private developers in working out the program also made the right-wing parties accept the major features of the program. The overall environmental goal of Hammarby Sjöstad was to achieve 50 per cent less emissions than in previous areas (Iverot and Brandt 2011).

To achieve that a more detailed vision had to be worked out. This vision building was an interactive process between the City of Stockholm and the local infrastructure companies (Loftus 2011), whereas Vernay et al (2011) noted the prominent role of technology related actors, in contrast to the future inhabitants that did not have a say in the process. In 1996 the city invited the infrastructure companies to propose technological solutions. After a first

'business as usual' proposal which was rejected by the City, the second proposal was more innovative and aimed at closing metabolic flows. This eco-cycle model which described the environmental solutions used for energy, waste and water became known as the 'Hammarby model' (Vernay et al. 2011). Water management was a key element connecting the various areas of urban management. Water management was integrated in various areas, e.g. sewage sludge is used to produce biogas. Heating and cooling is produced during the waste water treatment, sludge and organic wastes are used as fertilizers and rainwater is collected separately and discharged into the lake after a settling process (Loftus 2011).

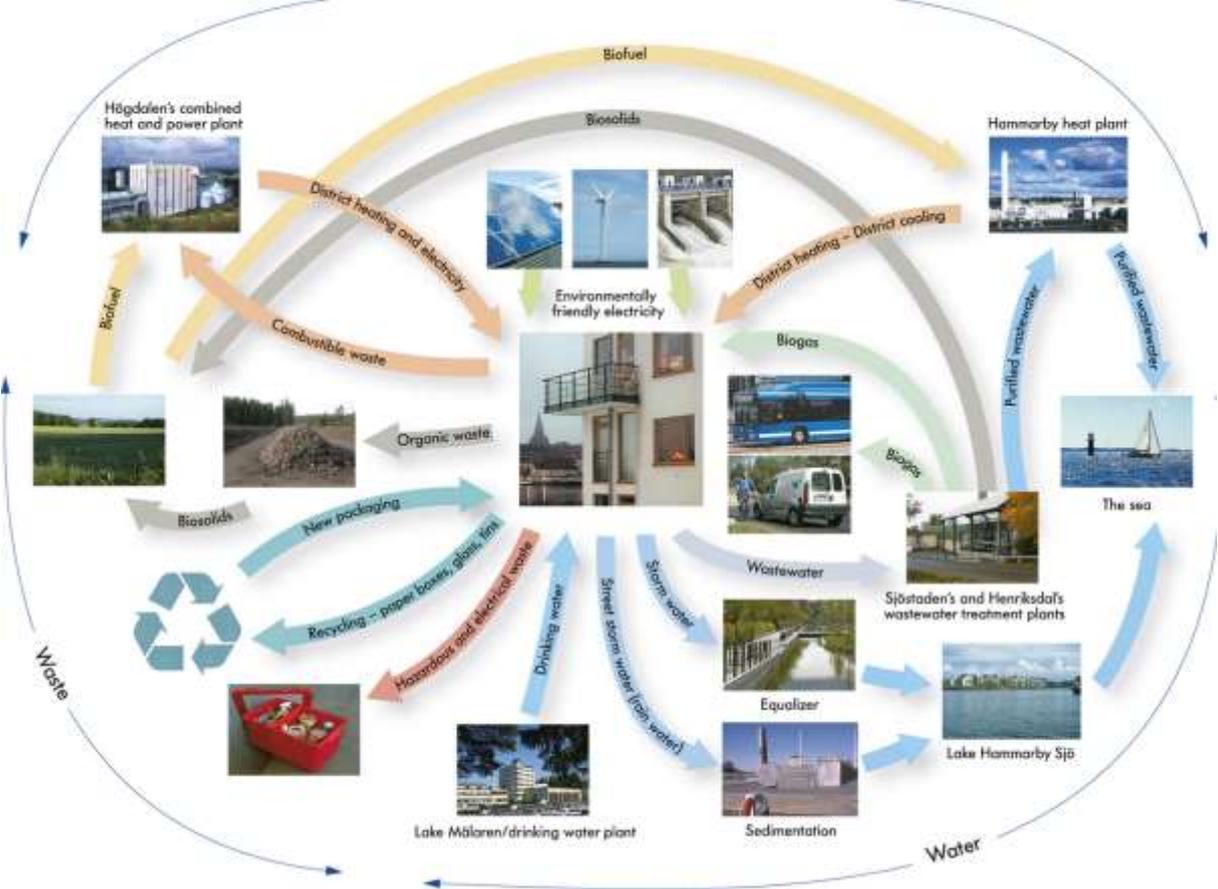


Fig. 10 The Hammarby Model (Loftus 2011, p. 4)

The strict environmental requirements demanded a completely new methodological approach whereby officials from the relevant administrations and authorities formed a unified management team. The work was conducted on an interdisciplinary basis, which allowed for quick decision-making processes improved project coordination. The Project Team consisted of representatives from the City's offices for City Planning, Roads and Real Estate and Environment and the infrastructure companies (Svane 2005). The other stakeholders worked together in teams for each development unit. Thus, the Project Team's counterpart in each development was usually a temporary organization of a developer with his consultants or a contractor with his sub-contractors (Svane 2005).

Results

Stockholm's holistic environmental approach to develop Hammarby Sjöstad has gained international attention and is still widely held as a model for integrated planning and resource use minimization. The integrated approach and management applied can easily be transferred and suited to different conditions (Loftus 2011). At the time of the project's start, taking a holistic view of the urban environment, with a focus on system-based technical solutions, it was still a new approach. It allowed for improved cooperation between stakeholders and also for interdepartmental innovations in technology and management. But since the environmental program had been drafted after the planning process had already started it created difficulties with the implementation of the program. Also the holistic view led to the prioritization of system-based technologies, which sometimes made the integration of emerging technologies more difficult.

A project assessment from Loftus (2011) found that the 50% reduction was not accomplished (instead 28-32% reduction) due to unrealistic goals and not previously anticipated behavior patterns from citizens. In sum, though the district is not yet fully complete, Loftus (2011) found that the initial goal of a 50% reduction in environmental impact was not achieved but that for certain aspects (water consumption, public transport) it is approaching these goals.

Concerning water management a pilot wastewater treatment plant has been built specifically for the area in order to evaluate new sewage treatment techniques and a network of storm water canals treating rain water locally has been installed (Fig. 11). Once the water from streets, yards and roofs had settled it was discharged to Hammarby, rather than being drained into the wastewater treatment plant.

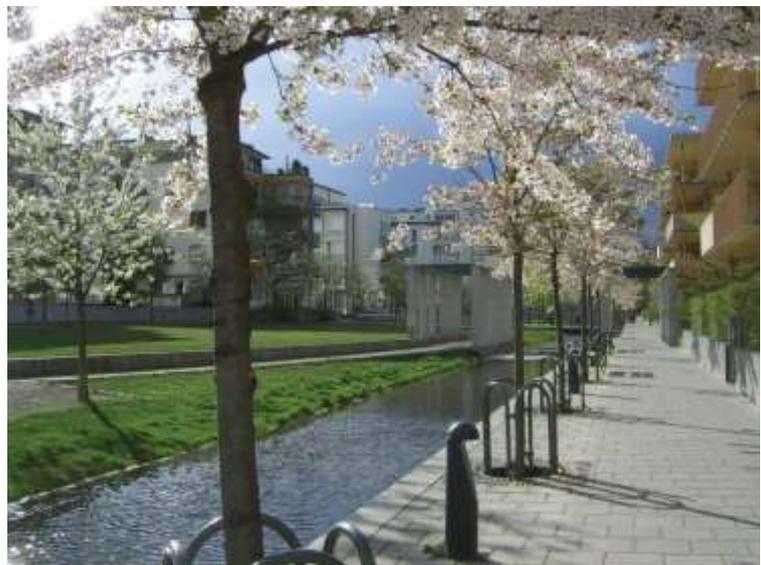


Fig. 11 Storm water canal in Hammarby Sjöstad (from hammarbysjostad.se, photo by Malena Karlsson)

From a social sustainability point of view, the project's aim to promote social heterogeneity has not been achieved, with the neighborhood's residents mostly belonging to a homogeneous group of higher socio-economic status. Increasing construction costs and the removal of housing subsidies throughout the project were to some extent the reason for this trend, as well as the shift in political direction which led to a change in the percentage of land allocated for public ownership, own use and rental use (Loftus 2011).

Nevertheless the Hammarby project has set new standards for integrated and ecofriendly urban management and achieved huge successes. Two important factors for the projects' success were the informal management complementing the traditional formal management and the provision of information to citizens to influence behavior patterns. Public land ownership was a decisive factor in determining to what extent environmental considerations would be included in the projects' design (Loftus 2011).

5. Newspaper analysis

First step of the analysis was coding the articles within the three code-families 'incentives', 'ideas' and 'capacities'. Within each code-family a subset of codes was developed from the interviews based on the theoretic assumptions.

5.1 Rotterdam

Thirty-three articles from various newspapers around the world publishing in English were analysed. The articles were published between 2007 and 2013. For 2006 no relevant articles were to be found. Interestingly no articles on Rotterdam's adaptation scheme were published in 2006, following the invitation of the CCI. The first articles from 2007 and 2008 focus mainly on vulnerability of and threats from climate change to Rotterdam. From 2009 onwards Rotterdam's importance as a global showcase is repeatedly highlighted. From 2010 adaptive solutions as export products gain attention. Articles between 2010 and 2013, report on Rotterdam's role in international partnerships and networks.

First step of the analysis was coding the articles within the three code-families 'incentives', 'ideas' and 'capacities'. Within each code-family a subset of codes was utilized.

Incentives

Most of the articles refer to climate change related external incentives as motivation to adapt. The coherent codes used were 'threats from climate change', 'vulnerability' and 'sense of urgency'. The quotes refer to global changes but also the great flood that wracked the Netherlands in 1953 to later events like Hurricane Katrina or Hurricane Sandy. Climate change related external factors posed a mayor incentive in Rotterdam's decision to adapt. A window of opportunity to act on the perceived vulnerability was opened externally through ex-president Clinton and the CCI's invitation to join the C-40 network. The CCI's role in the emergence of the adaptive concept was explicitly pointed out in the referring articles.

Internally boosting the city's image was an often referred to, important incentive. This highlights the success of Rotterdam's efforts to improve its image and the importance of image building as an internal incentive to act. An example for image building was the demonstration of a floating pavilion in the 2010 Expo in Shanghai. On the occasion of the Dutch National Day on 18th May 2010 the Prince of Orange delivered a speech on the floating pavilion at the Expo 2010 in Shanghai. The presentation of the Dutch pavilion in a floating structure sent a strong signal to the global community in terms of technological leadership and serves to advertise the new export product (States News Service, 18th of May 2010). The articles from foreign delegations to Rotterdam imply a commercial export of knowledge and technology abroad. Creating an export product was an incentive to adapt for businesses. The Carbon Disclosure Project found 2012 that

'European cities show a growing awareness of the economic opportunities of climate change.' to develop new business industries (M2 Press Wire, 28th of June 2012).

Other incentives, apart from vulnerability, the CCI and internal reputational and economic benefits, were opportunities from mainstreaming climate issues into other tasks, such as urban redevelopment or tourism (GreenSource, 1st of January 2013; Thai News Service, 15th of June 2010).

Ideas

The knowledge for the adaptive concept was initially mainly developed locally by the RCI and businesses. Main stakeholder in the development of the concept was the RCI as implementing body for the objectives put out in the IAB's report from 2007. The RCI was referred in context with the integrated concept of reducing carbon emissions to trigger economic growth (Modern Power System, May 12th 2010), the floating pavilion (CleanTechnica, 3rd of January 2013), the green roofs, sustainable tourism and knowledge exchange. Several references to innovative design and technology discussed the floating pavilion, the green rooftops concept and the water plazas, designed by the urban design and planning company 'De Urbanisten' (CNN Wire, August 19th 2013). According to an article published by Jean-Marie Macabrey in the 'ClimateWire' on June 1st 2009 'the 1990s floods made the Dutch Aware that they could not go on raising their dikes indefinitely, and that excluding water would not bring about sustainable safety'. This was the start for developing new ideas in case of dike failure, 'For the Dutch engineers, this was a cultural revolution [...]' (ClimateWire, June 1st 2009). After the development of the RCP concept (2009),



Fig. 12 Water plaza in dry season (from Molenaar et al. 2009, p. 7)



Fig. 13 Water plaza on a rainy day (from Molenaar et al. 2009, p. 7)



Fig. 14 Water plaza in heavy rainfall (from Molenaar et al. 2009, p. 7)

during implementation new ideas and impulses became possible through Rotterdams participation in international partnerships and networks. During the design of the concept in 2006 and 2007 knowledge exchange is not mentioned. According to the articles intensified knowledge exchange started in 2009 in line with Rotterdam's participation in international partnerships, e.g. with Ho Chi Min (E&E News PM, 27th of July 2011; States News Service, 9th of April 2013; Philippines News Agency, 8th of April 2013), and networks, like the C40 (E&E News PM, July 27th 2011), the CDP (M2 PressWIRE, June 28th 2012), the MoU with Ho Chi Min city (Philippines News Agency, April 8th 2013), the H209 Forum «Water Challenges for Coastal Cities» (Engineering News-Record, September 21st 2009) and the Strategic Partnership Agreement between Vietnam and the Netherlands (BBC Monitoring Asia Pacific – Political, Supplied by BBC Worldwide Monitoring, October 8th 2010 Friday). Although the overall impression from the articles is, that Rotterdam is providing, not gaining knowledge in these networks. Due to Rotterdam's situation as an early adapter, newspaper articles focus rather on Rotterdam as a showcase rather than on showcases and pilot projects used to draw up Rotterdam's adaptation concept. The general impression from the newspaper articles were that ideas for the adaptive concept were developed without external cooperation.

In short, ideas for the adaptive concept were initially mainly developed locally by the RCI and businesses. The line of thought – what happens when the dikes break? – developed in the aftermath of the severe floods in the 1990's. After the development of the RCP program (2009), during implementation new ideas and impulses became possible through Rotterdam's participation in international partnerships and networks, though the impression from the articles is that Rotterdam is providing, not gaining knowledge in these networks. The general impression from the newspaper articles were that ideas for the adaptive concept were developed without external cooperation.

Capacities

Capacities were referred to in terms of expertise in water management and urban design. 'Water management' was referred to most. This is coherent with the global image of the Dutch as leading experts on issues of water management. Throughout the centuries not just an outstanding expertise was developed, but also enormous capacities on water management have been built up. This is true for physical flood protection infrastructure, human resources, financing as well as a tight knit infrastructure on research and development. Therefore it is not surprising that 'water management' is top of the capacity list in this newspaper review. When it comes to 'design' there are several references to local solutions and to knowledge and implementation capacities from within Rotterdam. This is coherent with the results from the 'ideas' category above, that showed there were limited external knowledge infusions. It seems thus logical that development and implementation of innovative designs are rooted locally.

Furthermore the initial city leadership proved to be highly beneficial for initial set-up. 'City leadership' was referred to several times implicitly and twice explicitly linked to the emergence and the development of the adaptive concept (The Irish Times, December 8th 2009).

But most capacities could be made available through networks, an integrated concept and a collaborative approach. Within these networks knowledge is shared internally and results mainstreamed externally. 'European cities are demonstrating leadership and best practice in managing climate change at the local level,' said Conor Riffle, Head of CDP's cities program. 'The report shows that other cities can benefit by implementing similar strategies, like annual measurement and reporting of greenhouse gas emissions.' (cited in M2 PressWIRE, June 28th 2012). The integrated concept described the mainstreaming of not necessarily directly connected, functionalities. As U.S. Senator Mary Landrieu put it: 'We've learnt from the Dutch that you can have great protection, but instead of a wall, maybe you have a building, maybe you have a park,' she said. 'People say we can't afford that, but it can actually be cheaper to do it that way, because you can use it for two or three different purposes. [...]' (cited in Climate Wire, June 1st 2009). The 'collaboration' of the stakeholders in the RCI mentioned above is usually very hard to achieve and is thus quite unique.

Capacities were bundled and managed through the RCI as coordinating body. In the case of Rotterdam capacities to implement the adaptation concept were bundled in the RCI 'inspired by Bill Clinton's December 2006 visit to the Netherlands' (cited in Modern Power System, May 12th 2010). 'In January 2007, the City of Rotterdam, the Port of Rotterdam, Deltalinqs (an organisation representing industrial enterprises in the region) and DCMR Milieudienst Rijnmond (the Rijnmond (literally "Rhine mouth") environmental protection agency), announced they were joining forces to form the RCI and participate in the Clinton Climate Initiative' (cited in Modern Power System, May 12th 2010). According to the referred articles the RCI is responsible for planning and implementing the adaptive concept. As a result the RCI developed the Rotterdam Climate Proof (RCP) concept, which is referred to once explicitly and several times implicitly throughout the articles.

On the downside public awareness is the key to change individuals behavior and resource consumption. The lack of such was coded 'unawareness'. 'People are not worried, but they are not completely aware of the situation; they forget they live below sea level,' confirmed Arnoud Molenaar, a program manager at the Rotterdam Climate Initiative.' (cited in ClimateWire, June 1st 2009).

From the articles it becomes evident that there are already existing well developed capacities for water management in Rotterdam and the Netherlands in general. Additionally the biggest stakeholders with the most capacities have joined in the RCI. Since 2009 Rotterdam has engaged more in international networks increasing its knowledge capacity. More know-how has been developed by local firms and institutions from the start. The City of Rotterdam approached the

adaptation process as the leading partner. Also integrating interdisciplinary functionalities (e.g. leisure, housing, etc.) has helped utilizing existing capacities more efficiently. ‘Unawareness’ could proof to be a negative factor.

Summarizing the success factors for Rotterdam derived from newspaper articles were displayed in figure 15 below:

<i>Factors</i>	<i>Number of references</i>
incentives	
Showcase	19
Threats from climate change	11
vulnerability	13
Export product	3
International initiatives	3
Urban redevelopment	2
ideas	
RCI	8
Local innovation by firms	13
Historical knowledge	1
capacities	
Water management	9
RCI (collaboration)	8
networks	6
City leadership	2
Integrated concept	2
Unawareness	2

Fig. 15 Success factors for Rotterdam derived from newspaper articles (from author)

5.2 Stockholm

Thirty-one articles from various newspapers around the world publishing in English were analysed. The articles were published between 2002 and 2013. From 1996 to 2002 no relevant articles were to be found.

Incentives

External incentives were Resource depletion, respectively resource dependence. Particularly the search for alternative energy sources following the oil crisis in 1970 had attracted attention in Sweden early on (Jiji Press Ticker Service, May 27th 2008). Risks associated to climate change were less an issue due to relatively small direct impacts. The window of opportunity was opened through discussion on procuring green games, by developing the athlete village as a sustainable eco-city (Ottawa Citizen, January 8th 2005).

Reputational benefits were a major driving force in Stockholm. Economic incentives were referring to local subsidy schemes (Ottawa Citizen, November 26th 2006), benefits from long-term reduction of operational costs (Jiji Press Ticker Service, May 27th 2008), the creation of jobs in the sustainability sector, attracting firms and employees, as well as foster growth of this sector by creating green regional clusters building on existing industries (NEWS Press, May 27th 2013). Later on also creating an 'export product' an incentive for businesses to develop innovative adaptive solutions and join the adaptation process actively.

Again mainstreaming sustainability and climate issues into 'urban redevelopment' was a factor. A former industrial brownfield site was transformed into a valuable waterfront project and accommodated further population growth (States News Service, May 4th 2010).

Concluding, the most prominent external incentives were 'resource depletion' and a window of opportunity like the Olympic bid 2004. Internal incentives were reputational - the cities international image (showcase) and economic ones.

Ideas

As mentioned above the Swedish search for alternative energy sources and a more sustainable lifestyle had its origin in the oil crisis in the 1970's. This is also reflected in 'planning theory'. Richard Register is one of the most renown theorists and authors in ecological city design and planning. Two of the articles mention his books 'Ecocity Berkeley' (1987) and 'Eco-cities: rebuilding civilization, restoring nature' (1994) as inspiration for the development of the plan for Hammarby. 'The forerunner to Norra Djurgårdsstaden, Hammarby Sjöstad, one of the first eco-communities developed anywhere, emanated from Richard Register's eco-city theory on building cities for a healthy future.' (The Irish



Fig. 16 Sustainable design in the environmental information center Glashuset (from hammarbysjostad.se)

Times, December 17th 2010). From this theory a planning model was developed. 'The Stockholm planning model began in the 1980s as a reaction to urban renewal experiments of the 1960s such as Sergels Torg.' (Ottawa Citizen, January 8th 2005). Following this Stockholm model, the development was approached in a collaborative fashion with developers, eco-technology companies, power, water and transport utilities coming together to plan a closed-loop urban system. 'The town's success is largely due to a ground-breaking new strategy that intricately links the reduction and re-use of its water, waste and energy, known as the Hammarby Model.' (The Guardian, December 5th 2007). These references to the planning model developed step by step from Register's theory show an iterative process of developing innovative ideas.

From this model a holistic, 'integrated concept' was drawn. 'From landscaping, lighting and transportation to ideas about urban life' (Ottawa Citizen, January 8th 2005). This integration of water-, waste- and energy management is an interesting economic and political idea as it is highly efficient, saves resources and money and helped to reduce Hammarby's ecological footprint by 40%. To use available resources as efficient as possible and become independent from fossil fuels, the planners have come up with a mix of sustainable energy solutions. In the Information centre a fuel cell was installed in 2002 (Business Wire, June 13th 2002). The technology of the fuel cell was provided through a Finnish company (Business Wire, June 13th 2002). Solar panels were installed on walls and roofs (The Mirror, May 17th 2007) and a 'sewage treatment plant that produces biogas that's used to fuel gas stoves in the project and to power buses in Stockholm.' (The Toronto Star, August 25th 2004). Hammarby's 'waste management' has drawn a lot of international attention as well. It 'consists of a large pipe that operates by a powerful vacuum that speeds garbage along underground at about 70 kilometres an hour.' (The Toronto Star, August 25th 2004). The idea, design and development were created by a Swedish firm 'Envac Centralsug AB' (The Toronto Star, August 25th 2004). Development started in the 1950's and the first system was installed in Sweden in 1965.

The 'water management' largely refers to a separated sewage system. This is not a new idea, but reduces operational costs, water demand and pollution of fresh water bodies during sewage overflows.

To summarize, ideas for the integrated, adaptive concept were derived from 'planning theory', developing a 'planning model' and finally an 'integrated concept' as framework for innovative ideas. Different ideas were put into practice to create a redundant, reliable mix of sustainable energy sources. The technology for fuel cells was adopted from a Finnish company, whereas the vacuum waste collection system was developed locally. The celebrated design was created from a trial-and-error approach reviewing negative developments from the 1960's.

Capacities

'City leadership' is an influential capacity in the process. In the case of Hammarby 'Right from the start, the planning bureau of Stockholm City Council - which had acquired most of the land - has overseen the design process, from the development of a strategic master plan under the direction of architect Jan Inghe-Hagström to building on the ground in six of the area's 12 planning sub-districts.' (The Irish Times, June 11th 2009). This quotation displays quite well the leading role of the city throughout the whole adaptation process from emergence to implementation. It seems to be a decisive factor.

The city's strong position described above allowed the city to dictate explicit 'developer requirements' which ensured compliance with qualitative and environmental standards. 'We set the standard for the pavements, the materials, trees,' says Mr. Inghe-Hagstrom. 'The builders know the city will have the same quality on the ground.' (cited in Ottawa Citizen, January 8th 2005). Nevertheless this happened in the collaborative fashion described above 'The design code for each sub-district of Hammarby formed part of a development agreement between the city council and its developer partners.' (The Irish Times, June 11th 2009).

The factor 'collaboration' was dominant within the 'capacities' code family. It referred to the collaborative approach and the strong stakeholder collaboration. 'The city of Stockholm planning department has developed an unusual system of collaboration among the city, developers and architects' (Ottawa Citizen, January 8th 2005). The National from Abu Dhabi elaborated 'Preliminary work in the early 1990s to achieve the metamorphosis pioneered an interdisciplinary approach to urban planning with decisions taken by a unified management team to which several city authorities contributed staff.' (The National, May 22nd 2011). This was quite unique as the departments had seldom co-operated previously due to rivalries for funding and other scarce municipal resources. Under the collaborative planning process 'city planners outline a vision, and then detailed planning takes place with architects, developers, housing associations and government. They work closely, often meeting weekly, attempting to reach consensus.' (Ottawa Citizen, January 8th 2005).

Apart from leadership and collaboration raising public awareness and altering residents behaviour through the provision of information was a central strategy to reach environmental targets by reducing resource demand and emissions. An increase in public awareness was mentioned in 2006 (Ottawa Citizen, December 2nd 2006) and 2010 (The Irish Times, December 17th 2010).

'Costs' were estimated to be 3.7 billion US\$ (Ottawa Citizen, January 8th 2005). Significant investment and land-ownership by the city gave it power in dealing with the private sector to shoulder a substantial part of the investment (Ottawa Citizen, January 8th 2005). Massive financial capacities were needed.

To conclude, ‘collaboration’, ‘planning process’ and ‘city leadership’ could be identified as significant factors. Unsurprisingly, financial capacities – ‘costs’ – were an essential factor as well. Additionally the articles highlighted the importance of public ‘awareness’ and information to achieve demand reductions through behavioral changes.

The results from this chapter are displayed in the list of success factors below (Fig. 17).

<i>factors</i>	<i>groundedness</i>
Incentives	
Image	29
Export product	7
Economic Stimuli	8
Resource depletion	4
Urban redevelopment	4
Olympics	3
Job creation	3
Threats from climate change	2
Ideas	
Planning theory	2
Planning model	6
Integrated concept	9
Sustainable energy	18
Waste management	16
Water management	6
Innovative design	14
Capacities	
Collaboration	8
Planning Process	3
Public consultation	3
Costs	8
Awareness	6
City leadership	5

Fig. 17 Success factors for Hammarby Sjöstad (Stockholm) derived from newspaper articles (from author)

6. Interview analysis

List of interviewees

Stockholm:

- Mr B. Cederquist, architect and social planner for the municipal urban planning department (Interview was conducted at GlashusEtt in the Lugnetsallee 39 on November 21st 2013 at 13.00)

Rotterdam:

- Mrs v. Hanswijk Pennink, process manager at IAB during the drafting of the 2007 IAB Report, currently process manager at EDBR (Interview at on November 26th 2013 at 14.00)

- Mr P. v.Heelen, 'Ruimtje and Wonen' division of the municipal urban planning department (Interview per telephone on November 14th 2013 at 12.00)

6.1 Rotterdam

The interviews in Rotterdam were carried out with Mrs van Hanswijk Pennink, the project manager from the IAB, that was involved with the emergence of the adaptive concept and Mr van Heelen from the 'Ruimtje and Wonen' division of the urban planning department, involved with the development and implementation of the adaptive concept.

At the beginning of the analysis stood coding the interviews within the three code-families 'incentives', 'ideas' and 'capacities'. Within each code-family a subset of codes was utilized – 20 codes in 'incentives', 11 codes in 'ideas' and 26 in 'capacities'.

Incentives

According Mrs van Hanswijk Pennink 'global trends' were incentives to adapt: 'Therefore it was a subject for the IAB to look at. Also because it happened to be one those things [...] many other cities were looking into at the same issue at the time. So we had a lot of comparison material.' (van Hanswijk Pennink, 26.11.2013). That 'global trends' were not mentioned by Mr van Heelen, this could indicate that global trends played a role in the emergence of the idea to adapt, but no direct transfer of external solution for developing the concept

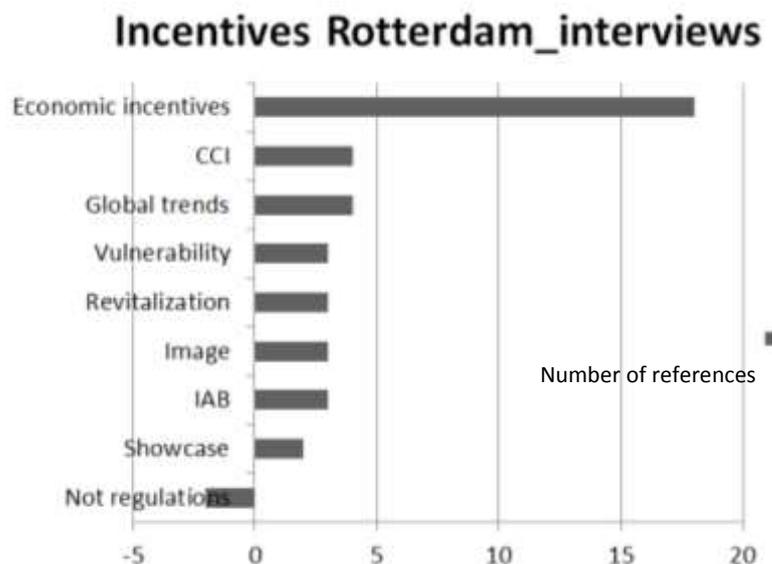


Fig. 18 Incentives for Rotterdam derived from the interviews, displayed by number of references (by author)

took place. Following the CCI's invitation, the IAB's recommendation for Rotterdam to pursue a climate change adaptation strategy was adopted by the city. 'That's pretty much what the IAB does. They take knowledge from other parts of the world and bring it to our table.' (van Hanswijk Pennink, 26.11.2013). She pointed out: 'I think 2007 was the window of opportunity because of joining the CCI in 2006. We were invited to join the CCI like all the other cities.' and 'Once you say yes to the CCI you sign a contract promising to reach certain targets at a certain time.' The CCI's invitation to Rotterdam is the starting point of the emergence of the adaptive concept and thus a major incentive.

'Vulnerability' as a climate change related incentive was mentioned by both interview partners. As Mr van Heelen put it: 'At the same time we understand that climate adaptation is necessary for the city of Rotterdam. Because we are a low-lying, open Delta city.' (14.11.2013). Naturally the geography and exposure of an area determines the degree of involvement with mitigation or adaptation measures. But as 'vulnerability' was only mentioned thrice this raises the question whether 'vulnerability' is assumed less important incentive than the economic incentives.

In Rotterdam strong internal incentives were 'economic incentives'. 'Economic incentives' includes the sub-factors 'economic growth', 'business incentives', developing an 'export product', and economic 'stimuli' for stakeholders, investors and politicians. Obviously 'business incentives' and developing an 'export product' were incentives for business stakeholders to join the adaptation process. 'Economic growth' and economic 'stimuli' were also a business incentive but also an interesting argument to political and governmental stakeholders. Overall economic incentives played a major role to ease the emergence and tap business actors' resources to implement the climate concept. On the other hand 'economic crisis' was a major draw-back to attracting stakeholders and investors. Furthermore urgent financial shortages led to a shift of priorities, rather distant and diffuse climate change threats became less important. Since economic crisis is an obstacle and not a success factor it is excluded in the listing below. Additional internal incentives were the integration in urban 'Revitalization' and improving the cities 'image' both describe hoped for side effects of the adaptation efforts. 'What also has been good for the city of Rotterdam that our international image has been changed from – let's say a post-industrial a bit downgraded city to a modern, climate adaptive and green and instructive city. So there is a lot of exposure been given on the theme of climate adaptation.' So creating a certain image or profile as a competitive advantage can also be a motivation to participate in adaptive concepts.

When asked for the importance of regulations for the emergence of the concept Mrs van Hanswijk Pennink replied: 'It wasn't the driving force. It wasn't the fact that EU regulations or national regulations or funding played a part in that.'(26.11.2013).

To conclude the CCI's invitation to Rotterdam in 2006 served as a trend setter. In its wake the IAB looked at global trends and recommended adapting. Then the RCI was established to develop and implement an adaptation scheme. The main incentives for the stakeholders (City of Rotterdam, port authority, companies, developers, etc.) to join the adaptation efforts were economic incentives. Furthermore Rotterdam's high vulnerability to climate change effects served as a motivation to adapt. Revitalizing the city and improving the image of the decaying, industrial port city posed further motivation. Rules and regulations did explicitly not play a role in this.

Ideas

Within the 'ideas' category knowledge exchange was the most applied code. Whereas Mrs van Hanswijk Pennink stated that there was no inbound knowledge exchange throughout the emergence. She explained: 'I looked in general at mostly European cities, because they are mostly comparable to ours. I started to look at the bigger port cities. [...]But there wasn't anything tangible, there weren't any pilot projects I could take and say we should do it this way.' (26.11.2013).

Mr van Heelen on the other hand mentioned several exchanges with developers, and research institutions on a more local level, but also a broader exchange on national level during the implementation. 'So we have developed a lot of knowledge here in the city ourselves. On this moment there are different universities working

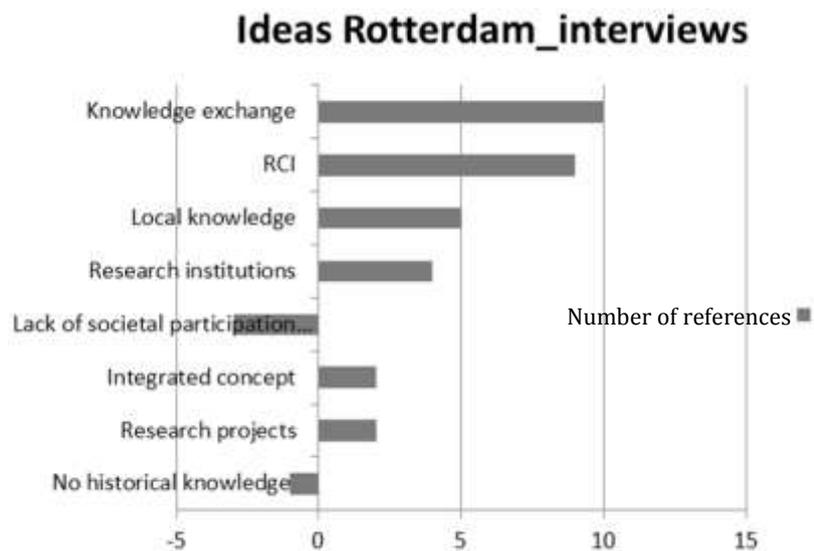


Fig. 19 Ideas for Rotterdam derived from the interviews, displayed by number of references (by author)

for the City of Rotterdam on several themes. [...] My experience is that for innovation and this kind of innovative research projects we had to rely on universities and institutions, e.g. Deltares.' (van Heelen, 14.11.2013). Interestingly 'research institutions' were only referred to with developing and implementing the concept. Throughout the emergence research institutions were explicitly not involved. 'Research projects' mentioned by Mr van Heelen, were 'Knowledge for Climate', a national program and the five research programs for each key theme of the Rotterdam Climate Proof concept. Coordinating the knowledge exchange and collaboration among all stakeholders was the main task of the RCI. 'That's why the RCI came about to act as a coordinator between all the different parties. To try and get this show on the road. They initiate

things, the consult with companies and organizations and they monitor what happens in this city, to make sure we achieve our targets.’ (van Hanswijk Pennink, 26.11.2013).

Apart from knowledge exchange ‘Local knowledge’, respectively local innovation played an important role. This could be due to the fact that Rotterdam was an early adapter without many international examples to transfer knowledge from. Additionally in order to achieve economic growth there had to be new expertise and technological solutions developed to export.

Synergies with other urban functionalities could be created making use of ‘integrated concepts’. ‘We also try to combine climate adaptation with our other main goals by creating a more attractive city by investing also in public space, parks etc. We try to combine different goals of the city and also assimilate our investments here in the city.’ (van Heelen, 14.11.2013).

The ‘lack of societal participation’ was mentioned by both interviewees when specifically asked for societal drivers. Both stated that societal actors were not interested in joining the process in the beginning. Furthermore Mrs van Hanswijk Pennink pointed out that the public is of little interest, as the climate proof strategy is aimed at the biggest emitters (port, industry), not at the general public: ‘We are talking to the larger companies who are the larger emitters, who are both benefiteres of a greener city and polluters on the other side. They are the ones that make a difference. [...] The general public ... whatever. If they are aware and they want to contribute that’s great.’ (van Hanswijk Pennink, 26.11.2013) This is a seminal choice in regard to the adaptation strategy chosen.

To summarize shortly transnational and international knowledge exchange did not take place. This could be due to Rotterdam’s role as an early adapter and insufficient knowledge capacities for transfer available. Local knowledge exchange on the other hand helped tremendously to develop the concept and its implementation. The coordinating body, the RCI, played an important role for developing the concept. Remarkable is the inclusion of and collaboration with research institutions and programs in Rotterdam. Societal participation did explicitly not play a role for developing the adaptive concept.

Capacities

When asked both interviewees confirmed the leading role of the municipal government. ‘City leadership’ was without doubt a driving force to the adaptation process.

Most references were made to the close collaboration of the stakeholders in Rotterdam ‘In Rotterdam it’s different. We have a very strong foundation of the larger companies being involved in the city and the port being involved in the city. And the city being involved in the port. We have a very close working relationship, very consultative, very much asking the companies to invest, not just financially, into their city and invest into the attractiveness and

liveability and to work with us developing the economy.’ (van Hanswijk Pennink, 26.11.2013).

Capacities Rotterdam_interviews

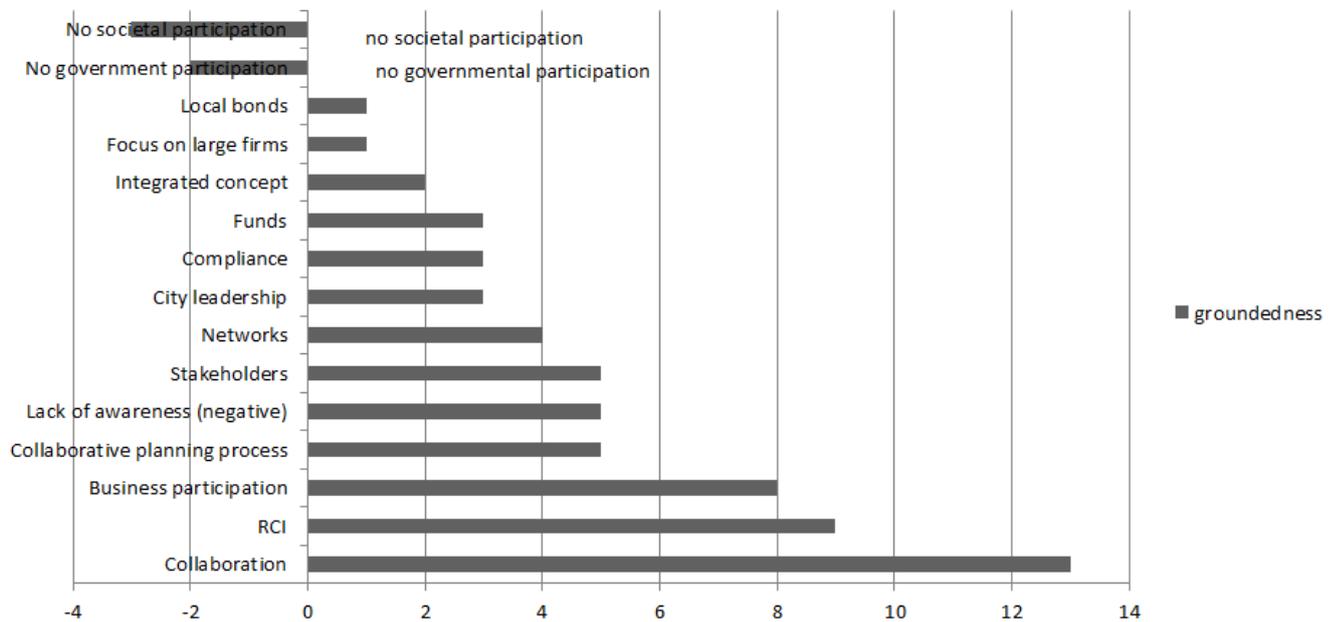


Fig. 20 Capacities for Rotterdam derived from the interviews, displayed by number of references (by author)

The good municipal-executive relationship mentioned above was indeed a very special entrenchment of public and private stakeholders unique to Rotterdam. Apart from this collaboration on the high level, Mr van Heelen also repeatedly referred to local collaborations between the City of Rotterdam, developers, research institutions, consultancy firms, etc. Qualitatively and quantitatively ‘collaboration’ stuck out as a prominent factor throughout emergence, planning and implementation. Another important capacity emphasized by Mrs van Hanswijk Pennink during the emergence of the concept was the consultative and collaborative fashion of the ‘planning process’: ‘We are very much a city that gets every single body and company involved. And we consult with them. From the very beginning everybody can input their ideas but also their objections. Because that way we can organize around it.’ Stakeholder inclusion and consultation seems to be a key point here.

This was confirmed once more by the interviewee’s answers when asked for the most important ‘success factors’. Both stated the consultative and collaborative planning process to be the prominent success factor. The stakeholder collaboration defined the capacities accessible to the project. The main stakeholders, respectively lead partners were: ‘The RCI being part of the government, the DCMR and the ‘Port of Rotterdam’ authority work together quite closely. They would be the driving forces the three of them together.’ (van Hanswijk Pennink, 26.11.2013). The RCI was important for developing the concept, coordinating and pooling resources. Other stakeholders were: ‘[...] the universities, the colleges, our research labs, our large companies, our cultural organizations.’ (van Hanswijk Pennink, 26.11.2013). Interesting is here the variety of participating stakeholders from leading economic firms, governmental institutions like the RCI

or the DCMR, to scientific institutions. For the emergence phase the 'port authority' played a fundamental role: 'It's very much driven by the government and the port in our case driving this whole transition phase.' (van Hanswijk Pennink, 26.11.2013). The port authority represents Europe's biggest export harbour with substantial capacities, economic importance and comprehensive logistic operations, making it Rotterdam's biggest emitter as well. In regard to the RCP's emission reduction goals this makes the port authority a major stakeholder.

Part of this collaboration was the 'business participation' mentioned in both interviews. Mrs van Hanswijk Pennink characterized this participation as follows: 'It's a close connection [between the local government and the companies]. They are feeding each other. On the other hand companies are being pushed by their customers.' The 'focus on large companies' targeted the biggest emitters with the greatest capacities and utilized the strong 'local bonds' Rotterdam's firms have with the city: 'The stakeholders in Rotterdam are very much connected to the city, they very much care about the cities development.' (van Hanswijk Pennink, 26.11.2013). So 'compliance' was strong in Rotterdam, as the affected firms were already involved during the development of the concept, the standards and the goals. Despite the good public private collaboration described above 'no societal participation' was mentioned by both interviewees for emergence and implementation. Top-down governance processes have known to be prone to fail over time and have thus been heavily criticized in the last two decades. Nevertheless this strategy has so far worked well for the Rotterdam.

The 'integrated concept' applied mainstreamed 'climate adaptation with our other main goals by creating a more attractive city by investing also in public space, parks etc. we try to combine different goals of the city' (van Heelen, 14.11.2013).

For the implementation of the concept obviously 'funds' were needed. These were mainly provided by local and national government. Though national funds were given indirectly: 'But there was not a direct interaction between Rotterdam and the national Government. Actually the subsidy was given through a scientific research committee.' (van Heelen, 14.11.2013). Through the integrated concept and particularly the involvement of public institutions additional funds became accessible: 'We had some sources from the Council. So we had our own budget. And then there was money coming from other research and innovation projects. Some institutions they had their own budgets for innovative projects. We could combine them all. But mainly money is coming from national and city.' (van Heelen, 14.11.2013). When asked for 'national government support' both interviewees denied any involvement apart from the subsidies granted.

But of course there were also 'obstacles' to the adaptation efforts. For the emergence time and ambition were limiting, opposed factors, as well as agreeing on priorities during the economic crisis: 'Obviously when you are having an economic crisis people might say the crisis is more important to me at the moment then building another green roof.' (van Hanswijk Pennink, 26.11.2013). For developing the adaptive concept the main obstacle was the lack of available

knowledge on how to implement the concept, the lack of awareness to climate change from urban planners ‘one of the main obstacles there is that we need to explain them very carefully that climate adaptation is not something what is happening over a long term but is also something which should be mainstreamed in urban development processes on a short term.’ (van Heelen, 14.11.2013), the cut-back of funds after 2014 and stakeholders problems caused by the economic crisis. Particularly Mr van Heelen, responsible for the implementation, repeatedly mentioned the ‘unawareness’ of urban planners, companies and the public as a major issue. When asked Mrs van Hanswijk Pennink confirmed that.

Summarizing shortly in the ‘capacities’ section collaboration was the most prominent code with most references. This became apparent in the municipalities cooperation with research institutions and businesses. The same goes true for the collaborative and consultative planning process with the stakeholders, which also helped to increase compliance with agreed standards. Again the RCI’s importance to pool capacities was underlined. In this regard the city could also profit from its networks. Financially funds were sufficient and provided by national and local government as well as research institutions and individual stakeholders. Other than funding national government did not involve in the process, neither did societal stakeholders. The City of Rotterdam, respectively the RCI, was leading the adaptation effort. Major drawbacks were the lack of public awareness of climate change issues and the economic crisis.

Below the accumulated factors gathered from the Interviews are displayed (Fig. 21).

<i>Factor</i>	<i>Number of references</i>
Incentives	
Global trends	4
CCI	4
<i>Economic incentives</i>	<i>18</i>
Economic growth	4
Business incentives	4
Export product	4
Stimuli	6
Economic crisis (negative)	3
IAB	3
Image	3
Revitalization	3
Vulnerability	3
Showcase	2

Not regulations	2
Ideas	
Research projects	2
Integrated concept	2
Lack of societal participation (negative)	3
Research institutions	4
Local knowledge	5
RCI	9
Knowledge exchange	10
Capacities	
Collaboration	13
Business participation	8
Compliance	3
RCI	9
Collaborative planning process	5
Networks	4
Funds	3
Stakeholders	5
No societal participation	3
No government participation	2
City leadership	3
Integrated concept	2
Lack of awareness (negative)	5
Focus on large firms	1
Local bonds	1

Fig. 21 List of accumulated factors gathered from the Interviews on Rotterdam with number of references (by author)

6.2 Stockholm

Incentives

The incentives to support the emergence and mainstreaming of climate mitigation measures into urban redevelopment in Stockholm were mainly connected to reputational incentives. Important pre condition was the already existing legislative – and policy framework on a national level and the high public awareness to sustainability issues (see Fig. 22)

In Stockholm and Sweden at large special conditions were created by a suite of national laws and 'regulations' aiming at increased sustainability and reducing the ecological footprint. This process already started as early as the 80's. 'So the main

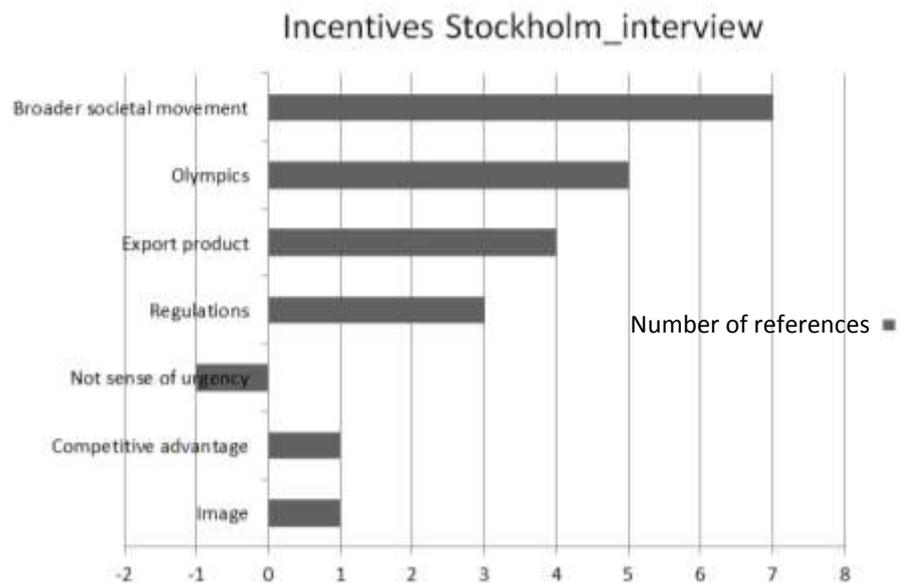


Fig. 22 Quantitative display of references to incentives from the interview with Mr Cederquist in Stockholm (by author)

structure was already there. And the national regulations supported or pointed out all the essential factors.[...] But it's also that we live in a country with a lot of regulations that are really working. The situation in Sweden, Stockholm makes it possible. '(Cederquist, 21.11.2013). Regulations were important to direct the development, since they were respected and compliance could have been enforced. Furthermore the regulations pointed out a more sustainable way to develop. At this point it is necessary to differentiate general trends in Sweden, from the particular decision to build Hammarby Sjöstad as an eco-city. The development of Hammarby Sjöstad was initially sparked by the efforts to build Stockholm's 'image' as host to the Olympics, the new district was intended to become the athlete's village. The cities goal was not primarily developing a sustainable profile, but to put Stockholm on the international map, to develop the cities 'image' by becoming host to the 2004 Olympics.

The incentive to develop a sustainable, integrated concept was not developed for the Olympic bid, but was actually part of an already existing 'broader societal movement'. As Mr Cederquist put it: 'But we had ecological ideas already before that. As I said Skarpnäck was built in the 80s. And we had an ecological program for building in Stockholm at large, already in the 90s.' (21.11.2013). When asked, Mr Cederquist said that neither a 'sense of urgency' nor 'threats from climate change' were a consideration. Also different economic incentives played a smaller role. Creating an 'export product' was no incentive from the beginning, but came about, more or less unexpectedly, much later in the process. 'The idea with the symbio city was formed in 2006 somewhere on the way. That's more from the national government. They say: 'Ah this is an idea, we could package it and sell it abroad.' But that was when it was already clear that Hammarby Sjöstad had drawn this interest.'(Cederquist, 21.11.2013). Similarly developing a sustainable profile as 'competitive advantage' seemed to be just a minor incentive, as only 'A few developing firms early saw the value in having local environmental programs within their firms. Some saw

this as a competitive advantage. But in the beginning of the 90s that was very weak.' (Cederquist, 21.11.2013).

Concluding, the decision to develop Hammarby Sjöstad in an adaptive, sustainable way was part of Stockholm's bid to host the 2004 Olympics. The city wanted to improve its global image by positioning themselves as a host to mega events. Hammarby Sjöstad was not an isolated pilot project, but part of a broader societal sustainability-trend. It was guided by a framework of national legislations. Later the Symbio city also became an important export product for Swedish firms. Initially economic incentives did not play a major role.

Ideas

Due to the afore mentioned broader ecological movement, existing regulations, technology, e.g. the vacuum waste collection and showcases, e.g. Skarpnäck, there was quite a lot of existing knowledge. 'But we had ecological ideas already before that. As I said Skarpnäck was built in the 80s.' (Cederquist, 21.11.2013). As the Scandinavian countries were the first to adapt to the worldwide changing conditions there was little to no external knowledge available, consequently the initial 'knowledge exchange' was rather limited. But there was some exchange among the Scandinavian

countries: 'What we had in the start was a sort of exchange between Helsinki in Finland and Oslo in Norway and Copenhagen so we were meeting because they had underway areas of the same kind. So we were exchanging ideas about environmental programs and things like that.' In the 90's the integration multiple urban planning functionalities was



Fig. 23 Quantitative display of references to ideas from the interview with Mr Cederquist in Stockholm (by author)

already known in Sweden. In Stockholm, though, rivalries for limited monetary and personal public resources had prevented cooperation amongst departments. For the first time different departments, public agents and developers collaborated. In the beginning city planners had proposed a first plan. Due to environmental issues this plan would not pass and only when the NGO 'Friends of the Earth' and the developers were consulted and changes to the first plan were made, the area could be developed. Mr Cederquist described the consultative planning process: 'In the first place the city has just a rough idea. And then we decide on the blocks and the developers for the blocks. And then we meet with these developers every month for a year, one year and a half. And exchange the progress in each project.' (21.11.2013). 'I think you can mainly

find the developers come in with a solution. Because in our program we are just pointing out expected [general] results.’ (21.11.2013). This was also accomplished by design competitions. Design competition raise attention, support discussion and generate commitment.

Later knowledge transfer was promoted to build the city’s image: ‘At that time they couldn’t imagine that building of an eco-city would attract **that** international interest. That is sort of a surprise coming up afterwards. And now they have been supporting the international information [exchange] more than ever before to put Stockholm on the world map.’ (Cederquist, 21.11.2013).

Concluding, as a pre-condition there was already existing knowledge available. To a greater part the knowledge was developed locally, due to limited external knowledge exchange during the emergence and design of the adaptive concept. Other knowledge and ideas were gathered through consultation and interdisciplinary integration. Detailed solutions were brought up by the developers.

Capacities

The national government was only involved indirectly in the adaptation. It provided ‘regulations’ and encouraged the business stakeholders in 2006 to develop the Symbio City as an export product. These effective ‘Regulations’ were also a factor in Sweden that was important for the plan development and implementation.

Locally the cities’ central position, ‘city leadership’ was a strong factor. ‘In this case it’s because the city as one hand having complete control or had a vision that was kept up for the whole area. Things are not just popping up. It’s step by step, an overarching concept. In the start having control of the land, choosing the de-

Capacities Stockholm_interviews

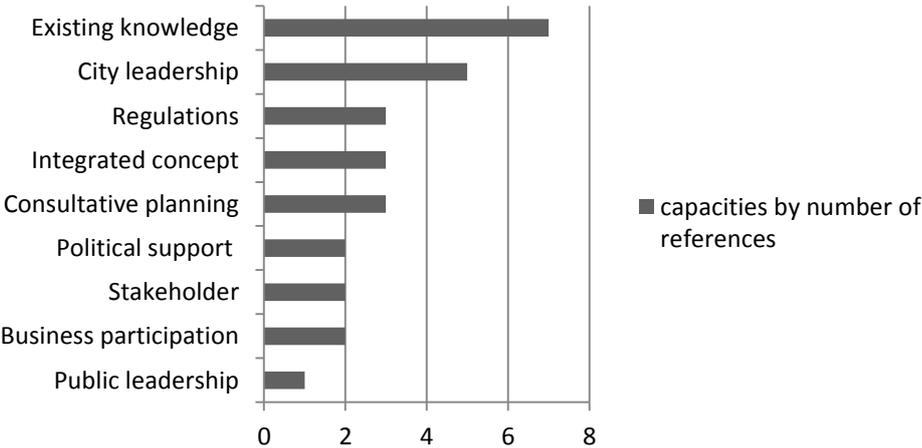


Fig. 24 Quantitative display of references to capacities from the interview with Mr Cederquist in Stockholm (by author)

velopers and controlling the investments in the area.’ (Cederquist, 21.11.2013). Coherently the city could introduce and keep certain standards by putting up explicit ‘developer requirements’. Furthermore the project received a lot of political support during the early stages ‘In the 90’s Hammarby was absolutely the top!’ (Cederquist, 21.11.2013).

Although 'public leadership' was pre dominant in the beginning, a result of Swedish governments early focus on sustainability is the widespread public 'awareness' to sustainability and climate change related issues 'People are very aware in Stockholm. Especially the middle class and the upper middle class.' (Cederquist, 21.11.2013). The finite nature of resources is the core of the discussion in Sweden, e.g. demand reduction, efficient use, etc. Though this awareness does not exclude typical 'NIMBYism' (Not In My Back Yard) 'But then when it comes to your own lifestyle its typical 'nimbyism'.' (Cederquist, 21.11.2013).

Consultation and involvement supported stakeholder participation and knowledge building. So 'stakeholders' besides the city, that were involved were the Environmental agency, developers, the environmental NGO 'Friends of the Earth', '[...] the water company, the energy organization, the transport organization and within the governmental organization the regional transport administration [...]' (Cederquist, 21.11.2013). Capacities for the emergence and implementation of concept depend on the variety, number and power of the participating stakeholders. The 'integrated concept' used aimed at creating synergies among interdisciplinary urban planning projects, pooling resources and building capacities. Mr Cederquist described it: 'You can't get anywhere with just one separate and one separate ... in a way the integration was quite natural.' (21.11.2013). A decisive capacity for the plan implementation was the substantial business participation: 'If you look back the city has invested 15 % and 85% is private investments. That is mainly developers but also the companies around – the energy company, the water company. [...]Three of the developers are public, they are publically owned housing companies. But the rest that is 30 developers they are private.' (Cederquist, 21.11.2013).

Since there is no social housing project in Hammarby Sjöstad the current development has led to a gentrification of the area and fuels the segregation of low to high income groups in Stockholm even further.

Concluding, in Stockholm, respectively Sweden at large there were already sufficient knowledge capacities developed. A prominent factor was the role of the public sector. Apart from the apparent public leadership, e.g. effective regulations on sustainability, the local government was leading the adaptation process, owning the land and choosing the stakeholders. Furthermore the project enjoyed initially a lot of political support. An integrated concept was successfully applied and used local capacities more efficiently. The importance of consultative planning became apparent when the first plan failed on environmental issues. Business participation was important for providing technological solutions and shouldering 85% of the necessary investments. Although the project succeeded as part of a broader societal movement, it failed to meet its targets fully. Despite a high level of awareness, typical 'NIMBYism' behaviour led to increased consumption of goods and resources. The lack of a social housing program has resulted in a gentrification of the area and increased segregation between rich and poor. The list below summarizes all factors extracted by the interview:

<i>Factors</i>	<i>Number of references</i>
Incentives	
Broader societal movement	7
Olympics	5
Regulations	3
Image	1
Export product	4
Competitive advantage	1
Not sense of urgency	1
Ideas	
Existing knowledge	7
Local Knowledge	5
Knowledge exchange	2
Consultative planning	3
Integrated concept	3
Business participation	2
Design competition	1
Environmental NGO	1
Capacities	
Existing knowledge	7
City leadership	5
Integrated concept	3
Consultative planning	3
Regulations	3
Business participation	2
Stakeholder	2
Political support	2
Public leadership	1
Awareness	1
NIMBYism	1
Funds	1

Fig. 25 List of the success factors for Hammarby Sjöstad derived from interviews (by author)

7. Comparison

The codes derived from interviews and newspaper articles were merged within each case study. Afterwards the combined codes of both cases were merged and compared to one another and the results from scientific publications (Ch. 4). This set of codes was prioritized according to quantitative and qualitative relevance. Principal difference between the two cases were the target and the planning approach. Whereas in Rotterdam vulnerability determined the action taken, mostly dealing with the adaptation to impacts from climate change and mitigation measures aimed to decreasing Rotterdam’s CO2 emissions by half. Stockholm on the other hand tried to adapt to socio-economic challenges from population growth, resource depletion and – dependency, developing a closed urban metabolism loop, based on linking infrastructure and altering residents behaviour. So Rotterdam’s technology based, structural mitigation-adaptation strategy was compared to Stockholm’s more mitigation based holistic eco-cycle approach

7.1 Rotterdam

Incentives

The incentives could be grouped into internal and external incentives. External incentives were on the one hand natural factors, like Rotterdam’s’ geographic exposure, lying in a delta, and its’ high degree of vulnerability. A window of opportunity was opened to the adaptation process when an international environmental initiative (the CCI) invited Rotterdam to join. Global trends were considered for determining the development options for Rotterdam.

From the internal incentives economic and reputational ones were most influential. ‘Image’ building and ‘economic incentives’ were also quantitatively the most referred to. ‘Image’ combined the codes ‘image’ and ‘showcase’. Boosting the city’s image was not just a political motivation but also in the interest of businesses establishing Rotterdam as a

Incentives Rotterdam_merged

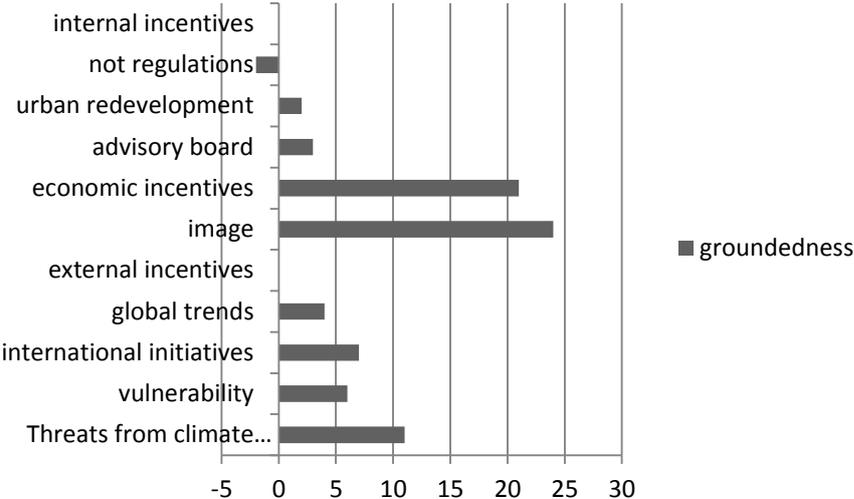


Fig. 26 Merged incentives for Rotterdam by number of references (by author)

frontrunner in climate adaptation and CCS technology, for attracting investors, stop emigration of young highly educated professionals and establish Rotterdam as a tourist destination. Marketing and communication was also a central pillar of the RCP program (Ch. 4.1).

Economic incentives were a key motivation in Rotterdam. On the one hand the initial role of the CCI in the climate proofing approach was influential, promoting economic development for overcoming and benefitting from climate change. On the other hand the business sector already had a great influence on the local governance and the city's development through a close entrenchment with the public sector (Ch. 4.1, 6.1) and also supported economic development. Also 'Urban redevelopment' was a political, social and economic incentive to engage in the adaptation process. Adaptation was seen as means to revitalize the city.

Ideas

Rotterdam being an early adapter or cities with unique conditions had to rely on the local knowledge, respectively local innovation, scientific research, as well as knowledge and resources from collaborating businesses, which were otherwise unavailable to public planning agencies.

The newspaper articles often referred to 'local innovation' capacity in Rotterdam. 'Scientific research' was combined from the codes 'research institutions' and 'research projects'. In Rotterdam the local development of innovative solutions was supported by the good collaboration with companies and scientific

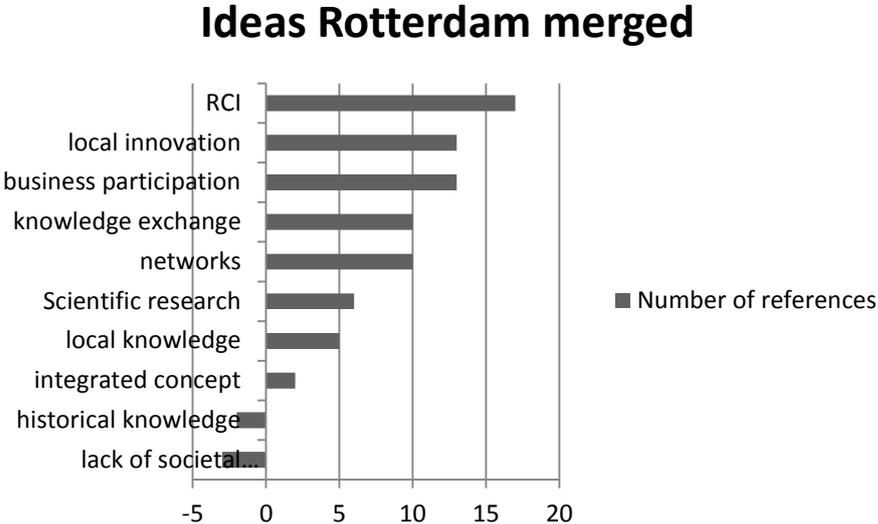
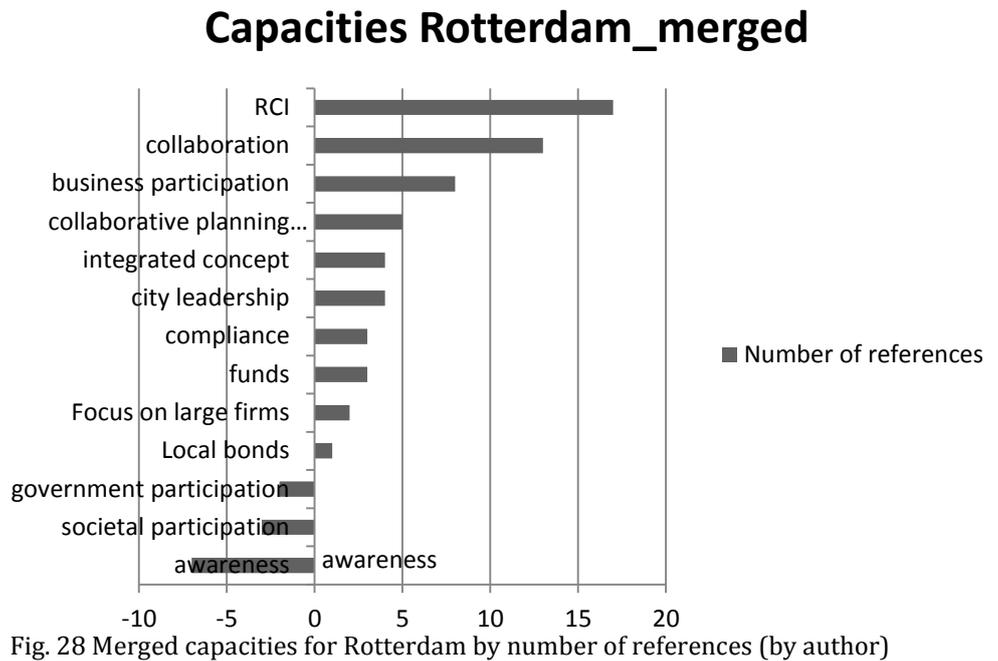


Fig. 27 Merged ideas for Rotterdam by number of references (by author)

institutions. A definite success factor in Rotterdam was the establishment of a 'coordinating body', the RCI. Using an 'integrated concept' allowed for creating synergies between public actors, increased the information exchange and thus helped to build knowledge capacities. Other ways to exchange information were accessible to Rotterdam through a variety of networks and partnerships. 'Networks' referred to knowledge networks, public-private networks and inter-municipal networks. According to the interviews societal involvement during the conceptual phase and its' participation during implementation did not play a role.

Capacities

'Capacities' was the most comprehensive set of factors. The emergence of the climate proof program was greatly benefitted from city leadership and municipal capacities to set up and connect to other major actors. Once the RCI was established it took over the leadership



function from the city. The RCI served as a platform for information exchange and to connect stakeholders, supporting the collaborative approach and raising a broad stakeholder participation. The interviewees highlighted the degree of 'collaboration' and the 'collaborative planning process'. Taken together those were quantitatively the dominant factor. Also qualitatively, based on the literature reviews and the interview contexts, the importance of collaboration as a key success factor was confirmed. As locally unique feature the interviewees point out the programs 'focus on large firms' and the strong 'local bonds' of firms in Rotterdam that resulted in a high 'compliance' with the concepts goals. 'Business participation' in general was a strong point of the development. On the downside the current economic crisis has taken its toll on the progress of the adaptation efforts in Rotterdam. This demonstrates that unexpected external economic influences can become an obstacle in an economy dependent development.

Funds were found to be essential for the implementation. Funds were sufficient and provided by national and local government as well as research institutions and individual stakeholders. Other than funding national government did not involve in the process, neither did societal stakeholders. The lack of 'awareness' was identified as a challenge and became apparent from articles and interviews.

7.2 Stockholm

In Stockholm a collaborative approach was chosen to integrate sustainability and climate issues into urban planning objectives, by developing a closed, circular urban metabolism model.

Incentives

The external incentives included natural occurring incentives, e.g. 'climate change' and 'resource depletion', and socio-economic incentives, such as population growth. A window of opportunity was opened by the candidature to host the 'Olympics'.

Internal incentives posed by far the greater motivation. Political and social conditions were favourable for the emergence of the concept as there was a broader societal sustainability movement and a framework of policies and legislations. Internal incentives were predominantly reputational ones. Building the city's image and positioning it as global

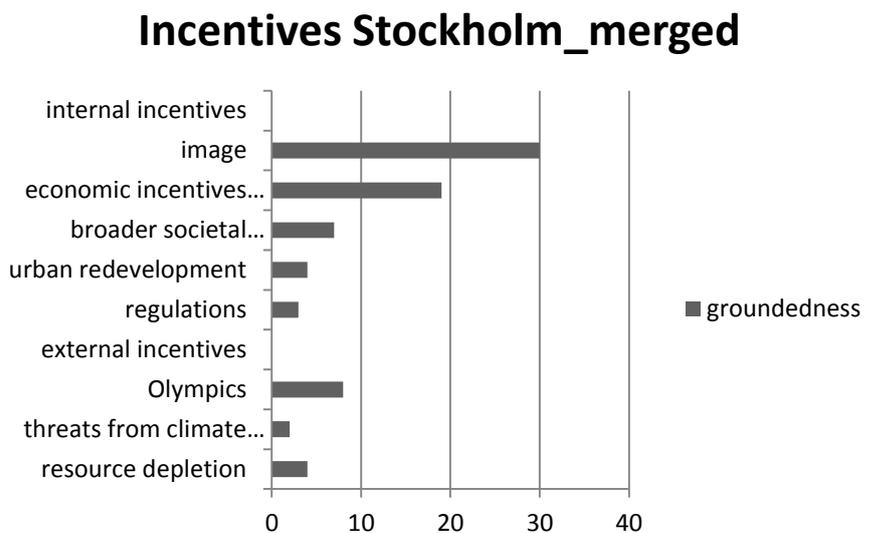


Fig. 29 Merged incentives for Stockholm by number of references (by author)

player were the strongest incentives. In Stockholm the political support for the emergence of the environmental vision was motivated by the chance of putting Stockholm on the world map by hosting a mega event. This motivation overcame differences between the political parties. Back then nobody thought that international attention would not be triggered by the Olympics but by their model for sustainable development design of the athletes' village. In the conceptual phase 'economic incentives', were consisting of 'job creation', competitive advantages' through technological leadership or know-how, or benefits from subsidies and tax exemptions. Developing an export product and marketing the symbio city model worldwide only became possible in 2006 and did not influence the emergence phase in the mid 1990's. To keep exporting expertise and technological innovations Sweden needs to actively shape the global development of ecological urban planning through their own research and development. Therefore apart from the successful interplay of public authorities, the general public and businesses an increased involvement of scientific research and institutions is necessary to stay a frontrunner in terms of reputation and technology.

Ideas

Since sustainability had been an issue in Sweden since the 80's a wide range of knowledge was available. The quantity and quality of existing knowledge in Stockholm and Sweden was quite unique, only few countries made sustainability an issue that early or have built such capacities of expertise and technical know-how prior to the adaptation process.

Especially locally developed knowledge – 'local innovation' – received a lot of attention. It included the codes 'energy', 'water' and 'waste management', which were most referred to in the newspaper articles. For the early adapters the local development of knowledge was compelling, since there was hardly any external

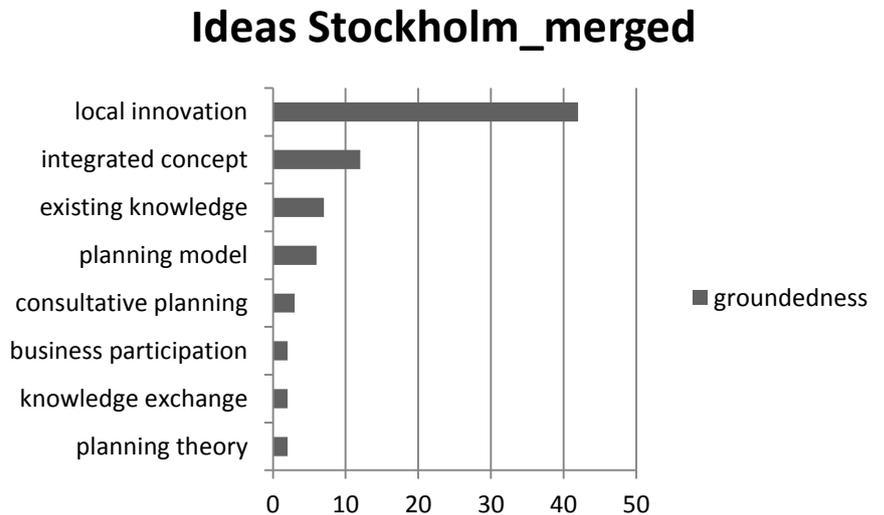


Fig. 30 Merged ideas for Stockholm by number of references (by author)

'knowledge exchange'. This will be less the case in the future, as more and more knowledge on adaptation becomes readily available. Both sources underlined the importance of the 'integrated concept' and 'consultation'. The integrated approach fused prior separated departments and thus stimulated an increased and improved knowledge exchange and increased collaboration, while making more efficient use of limited public resources. This was further supported by coordination and good project management of the City Project Team, that managed and monitored the mainstreaming of sustainability in all stages. Closing the urban metabolism in the district required massive efforts, know-how and changes in infrastructure and architecture. The infrastructure companies and developers intrinsic motivation to do so was small, since higher initial investments would only pay out in the long-run. But a collaborative approach to vision building involving private stakeholders, was motivation for private actors to develop solutions and generated a high participation and commitment. Another important source of knowledge were solutions provided and developed through design competitions, that simultaneously increased the commitment to the concept.

Capacities

Characteristic for the situation in Sweden in Stockholm there was already 'existing knowledge' available, the people had a certain degree of 'awareness' and there were 'regulations' in place that supported the sustainable urban development. This was a situation probably only few other cities could relate to.

City leadership was prominent in shaping the local conditions. The city was initiator and driving force to the development. It shaped the 'collaboration with other stakeholders', decided on the 'integrated planning approach', opened up to 'consultation' and encouraged 'business participation'. The two codes most referred to in this category

Capacities Stockholm_merged

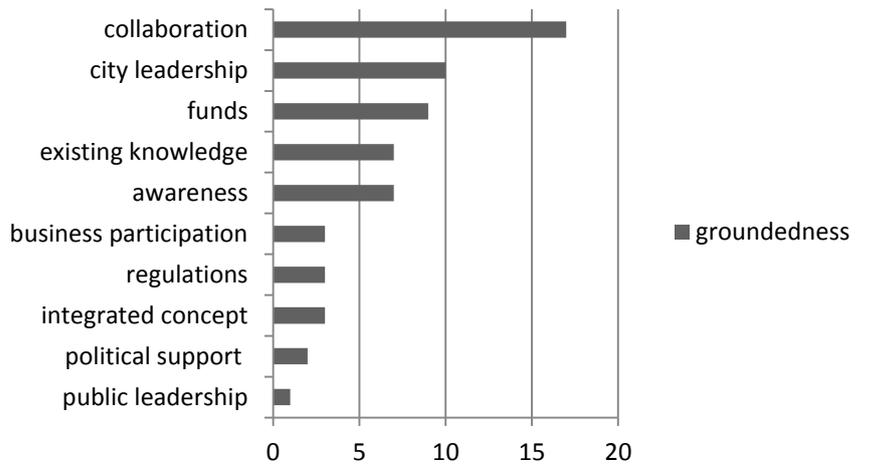


Fig. 31 Merged capacities for Stockholm by number of references (by author)

were 'collaboration' and 'collaborative planning'. Of course these factors are case dependent. In Stockholm the city's planners did initially not consult with others and almost failed the project. Only when they consulted with the environmental stakeholders the plan could be improved and implemented. So 'consultation' was a factor that was recognized as being relevant only later on in the process. Especially the participation of private stakeholders during vision building helped to create consensus, raise political support and private commitment. 'Business participation' was essential to access expertise and resources that are exclusive to private firms, furthermore large developments need common efforts as they would overstretch the welfare state's capacities. 'Business participation' is not an intrinsic motivation it has to be stimulated and fostered. Economic incentives or monetary compensation have proved helpful in this context. Furthermore part of the targeted demand and emission reductions were to be achieved by altering residents behaviour. This worked regarding the reduced emission of unwanted substances or the increased use of public transport (Ch. 4.2). It did not work concerning personal consumption of energy and goods due to typical NIMBYism behaviour.

Although the City of Stockholm had the leading role in project governance, particularly in determining the roles and responsibilities of the building contractors, it did not set responsibilities for implementation and monitoring of the environmental goals. It was widely criticized that the environmental program failed to outline a sufficient and effective follow-up monitoring and limiting a detailed assessment. Thus Hammarby Sjöstad's goal setting was not systematically evaluated against performance, it suffered from a lack of baseline data and from unclear responsibilities for the evaluation. Follow-up of results should be planned as part of the goal setting process, where the necessary baseline data as well as the responsibilities for goal monitoring and the feedback process can be determined.

7.3 Merged factors Rotterdam and Stockholm

In this chapter the merged data from interviews (Ch. 6) and newspaper article analysis (Ch. 5) will be added to the data derived from scientific publications and policy papers (Ch. 1-4), crosschecked, validated and the essential factors to urban climate planning identified and displayed (Fig. 32-34)

Incentives

External incentives

As suggested in the scientific publications (Ch. 1.1, 2, 4.1) a city's vulnerability and exposure to climate changes is a determinant for the city's involvement in climate proofing urban development. This was also reflected in the collected data. Due to its geographic exposure and economic importance vulnerability was an issue in Rotterdam whereas in Stockholm, that

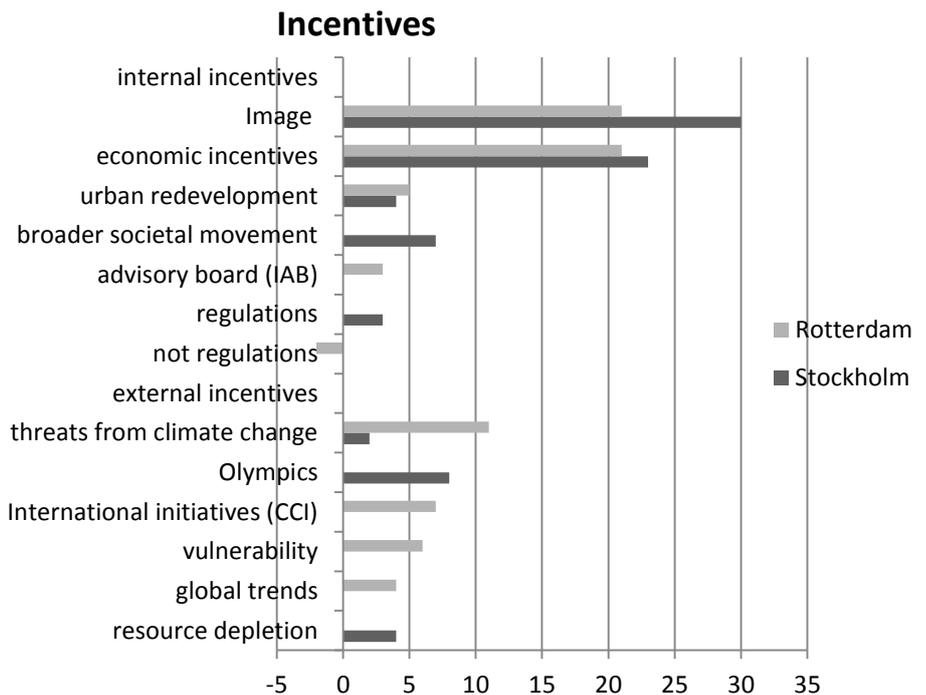


Fig. 32 Merged incentives for Rotterdam and Stockholm by number of references (by author)

is not as exposed, socio-economic factors, such as resource depletion, geopolitical dependence and population growth were discussed (Ch. 4.2, 5.2, 6.2).

Also common to both cases was the external igniting spark firing up the process of sustainable and adaptive development. In Stockholm it was the candidature to host the 2004 'Olympics' and in Rotterdam it was Mr Clintons invitation to Rotterdam's mayor that initiated the whole process.

Internal incentives

The driving force behind the realization was the public and private decision-makers wish to boost their city's images internationally while creating benefits. To stimulate decision makers, stakeholders and investors participation in the adaptation process several internal reputational or economic incentives were important as well. Building the city's image internationally was a strong driving force in each case, this was confirmed quantitatively and qualitatively (Ch. 5, 6).

As indicated in the scientific literature and confirmed in the case studies economic incentives, such as creating an export product or gaining a competitive advantage or creating jobs, were essential (2nd most referred code group). More specific creating an export product and economic stimuli, such as tax exemptions or subsidies, were common to both cases. In both cases adaptation measures went hand in hand with urban redevelopment of rundown neighbourhoods. Though this may not be the decisive factor for adapting, still it creates win-win solutions in the sense of an integrated approach mainstreaming climate targets in other urban planning tasks.

Due to the different local conditions and development approaches was the local vulnerability to climate change impacts in Rotterdam and sustainability as a societal issue in Stockholm the key factors for the emergence of the concepts. In Stockholm sustainable urban development had already been introduced and was supported by a broader societal trend towards more sustainable development and a reduced economic footprint. The Swedish government had taken the public lead on the countries sustainable development and substantiated this with the according laws and regulations.

To conclude external igniting sparks initiated the emergence of the concept but once it has emerged the realization is dependent on internal political and economic benefits. In how far consequences from climate change pose as incentive is dependent on the geographic location and the degree of vulnerability.

Ideas

In the two case studies the common, quantitatively most prominent denominator was local knowledge or local innovation since a transfer of knowledge was not possible yet at that point of time. Any case features some conditions comparable to other projects and

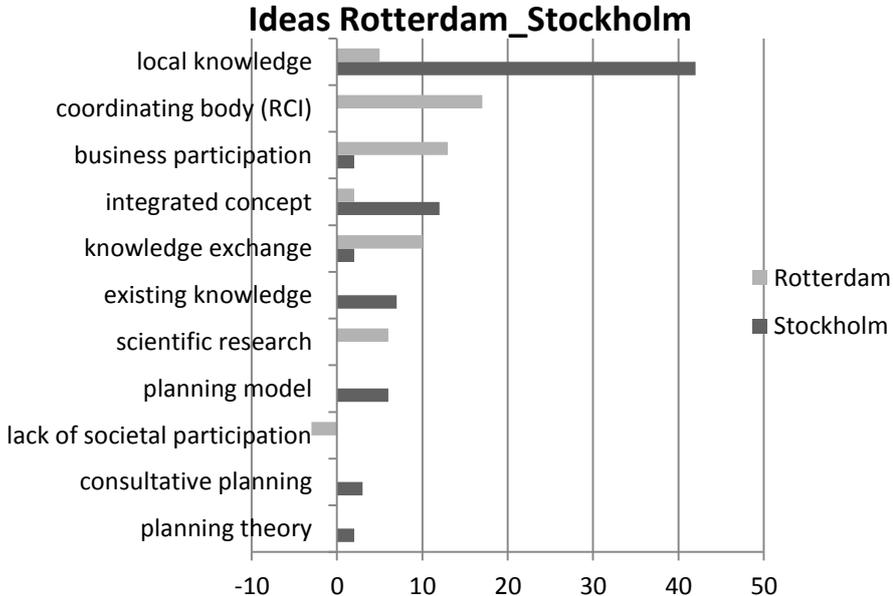


Fig. 33 Merged ideas for Rotterdam and Stockholm by number of references (by author)

some that are unique to the case due to historical development, local geography, exposure, etc. Therefore for any case at least some ideas have to be developed locally to fit the unique local conditions. So local innovation or local knowledge is an essential factor for adapting. This is

supported by Dobbins, Simmon and Garrett (2007), that stress the importance of knowledge exchange and the diffusion of ideas. The diffusion of ideas, like best practice, sustainable codes of conduct, innovative policy or technological approaches, generate an awareness for the issue and the currently applied approaches as well as an understanding for appropriate response actions (Ch. 2). Coherently in both cases the importance of knowledge exchange was discussed. Still inbound exchange of knowledge was limited, due to the limited number of related pilot projects. But a public-private exchange through good business participation substantially contributed to developing new ideas and technological solutions during vision building and the concepts implementation. In the public sector the integration of previously separate planning departments created new synergies and fostered informal interdepartmental exchange and cooperation in both cities.

Channels for exchanging ideas and knowledge are for example international networks, e.g. the CCI or the C-40, or umbrella organizations, such as the International Council for Local Environmental Initiatives (ICLEI), or national programs, such as the 'Knowledge for Climate' initiative in the Netherlands. In Rotterdam the main stakeholders in the city's governance were already well connected via fora like the EDBR or the IAB. A more inclusive platform, targeting all levels from citizens up to national government, was the RCI. An international knowledge transfer only started after concept drafting around 2009, e.g. the MoU with Ho Chi Min city or the H209 Forum 'Water Challenges for Coastal Cities' (Ch. 5.1).

Vision building is considered a crucial step in the planning process, as it could already alter outcome and reception of the vision (Van Dijk 2011). Iverot and Brandt similarly highlighted the visions importance for reaching political consensus and gathering broad political support (2011). Building a common vision for implementing the environmental program proved to be essential in both cases, as it communicated the goals of the project, both internally and externally, and encouraged actors to try new technical solutions. In Stockholm the developers involvement in vision building created political consensus. Though it was criticized for being introduced in the planning process too late and should thus be established at the beginning of project planning.

In Rotterdam common vision building led to a high participation of local businesses and research institutions in the climate proof program and its implementation. The private involvement also encouraged local companies to develop innovative technological solutions. It was not just important for developing new solutions, but also held resources and expertise otherwise not available to public bodies. Also determining the direction of development in Rotterdam was the 'focus on large firms'. This probably made the planning process easier but discarded needs and capacities of small and medium sized firms. On the other hand those large firms had very strong local bonds to the city and were willing to commit to the adaptation process. Additionally the cooperation with research institutions worked really well in

Rotterdam. From the beginning developing exportable expertise and products had been a goal, therefore public research institutions could be counted on, as well as private Research and Development in search for innovative technological solutions, such as the floating pavilions or the water plazas.

As described above participation and involvement of private and scientific actors was good and worked very well, for public participation the results are two-sided. On the one hand the public has not been consulted in the conceptual phase, in both cases this was done by municipal and business executives. Nevertheless the concepts proved to be successful. It might be concluded that public consultation during the conceptual phase is not essential. On the other hand public participation and the altering of residents' behaviour by providing information or setting financial incentives to achieve the targeted objectives were integral to the Stockholm approach. Information centers, like the Glashus Ett (Stockholm), can also be used for marketing of environmental and systems technologies and urban planning. Two good examples from Stockholm were the reduction of unwanted substances in the water following an exhibition of the information centre on the topic. Another example is the increased use of public transport, the public transport's share of daily travel in the inner city currently makes up 80%.

Rotterdam followed a technology based development path that was less dependent on residents' behavior and relied more on local companies and research institutions for planning and implementation. In a public environment that is indifferent to sustainability and climate change issues, a public-private partnership might just be the chance for direct action.

Overall knowledge is a crucial factor, since it promotes change by transmitting information and norms, both within and across countries. In the climate planning contexts ideas refer to the alteration of behavior through knowledge (Dobbin, Simmons, Garrett 2007). Due to the conditions discussed above in Stockholm there was knowledge readily available, paired with a higher degree of public awareness, whereas in Rotterdam knowledge and expertise had to be developed through public and private research and development with a smaller dependence on residents commitment and behaviour.

Capacities

The importance of collaborative planning has been widely emphasized in theories on collaborative planning, coalition planning, integrated planning etc. Boli and Thomas (1999) and Carmin et al. (2009) highlight its importance for planning and plan implementation.

Coherently collaboration was referred to quantitatively most in both cases. For both case studies the interviewees were asked for success factors. Both times 'collaboration' was mentioned as key factor. Unique to Rotterdam is the close collaboration with and strong involvement of private actors in local governance. Though collaboration' was quantitatively the most prominent code city leadership appeared to be a decisive factor. In both case

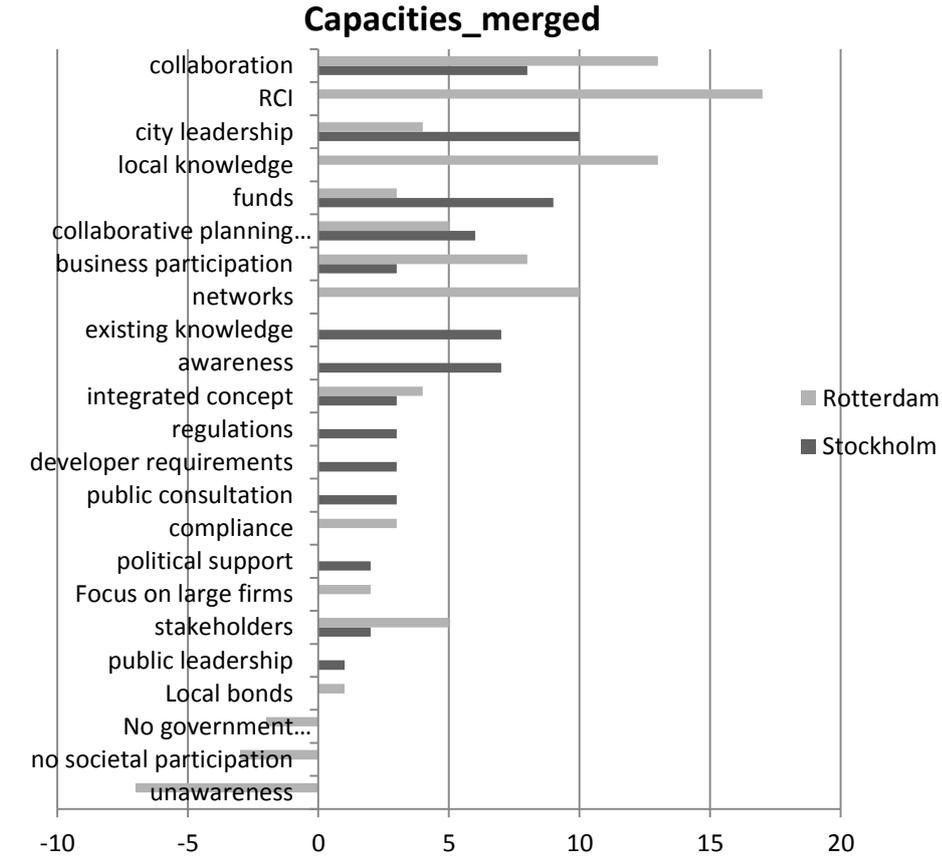


Fig. 34 Merged capacities for Rotterdam and Stockholm by number of references (by author)

studies the local municipal government took the central leading role during the emergence, the conceptual phase down to the implementation. A strong involvement of the city from the start soothed the introduction of the concept and allowed the city to set its own terms for the development. Furthermore it's a strong driving force to the process. Public involvement also served to ensure stakeholders and investors of the developments reliability. City leadership also guaranteed a certain quality of development and enforced compliance with the targeted standards. Municipal influence became well visible in the district planning of Hammarby Sjöstad during political power changes between socialists and conservatives. In Stockholm this leadership was further based on the city's landownership of the area, which allowed the city to establish a strict set of requirements for the private developers and to choose which developers to work with.

A coordinating body (RCI in Rotterdam and City project Team in Stockholm) has proved to be enormously helpful to the planning process and the program implementation (Ch. 5, 6). They served to connect and coordinate the multiple stakeholders to secure the continuity of the process and increased efficiency, by decreasing redundancies throughout the process. Especially the RCI also served as a common conceptual development platform and be part of the internal knowledge exchange by centrally collecting and distributing information to the involved stakeholders.

Furthermore in Rotterdam a special form of advisory board to the municipal government on the city's future development comprising of large, local company's executives and leading local politicians has evolved. On the hand this allows private companies to exercise a great deal of influence on the local government on the other hand this involvement resulted in strong bonds and a high commitment to the city's development and thriving. This kind of public private partnership might be suited for cases where sustainability or adaptation hasn't been mainstreamed yet. On the downside the current economic crisis has taken its toll on the progress of the adaptation efforts in Rotterdam. This demonstrates that unexpected external economic influences can become an obstacle in an economy dependent development.

Also very successful in both cases was the integrated approach taken. It helped utilizing limited public resources more efficiently. Interdepartmental integration of urban planning tasks and issues can increase cooperation and knowledge exchange between departments that might have been rivals for limited public resources before, as was the case in Stockholm prior to the district's development. Climate planning issues were integrated in urban renewal and district development as well as in smaller scale solutions like the roof top parks or the water plazas (Ch. 4.1, 5.1).

As money makes the world go round 'funds' were a hot topic in each case. In Rotterdam funds were mainly provided by public sources, businesses participating in R&D had to shoulder 10% of the costs. In Stockholm on the other hand 85% of the investments were executed by private developers.

Concluding the most influential for the successful implementation in both cases were the beneficial collaboration of a variety of stakeholders under strong guidance and supervision of the city. As public resources were limited the interdisciplinary integration of all public bodies involved in urban planning and a strong business participation in the process as well as mainstreaming climate issues into other urban planning goals proved to very useful.

<i>Factors</i>	<i>Data from chapter 1-4 (scientific publications, policies), 5 (newspaper articles), 6 (interviews), 7 (comparison);</i>
Incentives	Chapter
Exposure and vulnerability to climate change	1.1, 2, 3.2, 4.1, 5.1, 6.1, 7.1
Global trends	2, 4, 6, 7
External 'igniting spark'	5, 6, 7
Image	2, 3.2, 5, 6, 7
Economic benefits and growth	2, 3.2, 5, 6, 7
Urban redevelopment	2, 4.2, 5.2, 6.2
Socio-economic trends, (urbanization, population growth, geopolitics)	1.1, 2, 5, 6
Ideas	
Knowledge exchange	2, 5, 6
Networks, Information platforms	2, 5.2, 6.2

Local innovation	2,4, 5.1, 6.1
Research and development	5.1, 6.1,7.1
Participation	4, 5.1, 6, 7
Consultation	6
Vision building	1.3, 4.2, 6.2
Capacities	
Funds	1.2, 5.2, 6, 7.1
Political support	2, 6.2, 7.2
(City) leadership	2, 3.2, 5, 6, 7
Stakeholder commitment	4.1, 5, 6
Collaboration	2, 4.1, 5, 6.1, 7
Coordinating body (project management)	4.1, 6.1, 7
Integrated approach (mainstreaming)	4, 5, 6, 7

Fig. 35 List of identified success factors to climate proofing urban planning by chapters (from author)

8. Recommendations

In this final chapter a conclusion will be presented by answering the three research questions, based on the research and data analysis, outlining the windows of opportunity, success factors and strategies to climate proof urban planning.

As climate change, population growth and resource depletion (see Ch. 1.1) are issues of a more general, long-term nature, local governments often lack the capacities to plan and implement climate concepts.

(1) Which windows of opportunity can be identified to initiate climate related planning in urban context and which factors needs to be addressed?

The increased perception and awareness of exposure and vulnerability to climate change, due to natural hazards or the global debate of the climate related issues (Ch. 1.1), can open a window of opportunity to act. Similarly other socio-economic trends can put pressure on cities and make urban planning impact mitigation and adaptation to changing circumstances necessary. Urbanization, population growth, demographic change or geopolitical dependencies (Ch. 1.1) can bring urban infrastructure to its limits and open a window for smart, sustainable development approaches.

When there are sufficient internal economic or reputational benefits, external igniting sparks, such as hosting a mega-event or joining an international climate program, initiative, organization or network (Ch. 2, 5.2, 6.2, 7.3), can open a window of opportunity for introducing climate issues in urban (re-)development and infrastructure. For Stockholm the opportunity to bring itself to international awareness by hosting the Olympics and for Rotterdam ridding itself of the image as dirty, downgraded industrial port city were key incentives to take up action (Ch.4). Another window of opportunity in Stockholm was the city's landownership of the developing land. Due to this they could chose the developers, establish development requirements and a code of conduct.

Local initiatives by citizens or NGO's (Ch. 2) can raise awareness and support for sustainability -, climate - and urban planning issues or raise quality issues on the urban lifestyle. In the climate arena environmental, development and humanitarian aid organizations have the potential to diffuse ideas and practices among local governments through collaboration, advocacy, protests or policy papers (Ch. 2).

The driving force behind the concepts' realization, were connected reputational and economic benefits. Threats from climate change and internal reputational and economic benefits drive the emergence of climate issues, when once initiated through an (external) igniting spark.

Furthermore two essential groups of factors need to be addressed - ideas and capacities. On the one hand ideas, include the transfer and exchange of knowledge (Ch. 2) on different scales and across municipal, regional and national borders. And the research and development through

collaborating scientific and private actors, based on a broad stakeholder consultation and participation.

In the two case studies a transfer of knowledge was not possible yet at that point of time, so local innovation was essential (Ch. 5,6). In the case of later adapters more knowledge will be available, so knowledge transfer will gain even more importance over time.

Stakeholder consultation and participation can be realized and supported through vision building and policy formulation (Ch. 1.3). Building a common vision for implementing the environmental program can be interesting to communicate the goals of the project, both internally and externally, and encourage actors to try new technical solutions (Ch. 4.1). This study's results also highlighted the visions importance for reaching political consensus (Stockholm) and triggering a broad stakeholder participation (Rotterdam). A pitfall is late vision building as the vision cannot be fully integrated into all planning stages (Ch. 4.2). Therefore goals and visions should be established at the beginning of project planning, e.g. during the technical solutions choice phase and should also take into account the residents behavior.

Especially during the emergence and policy formulation climate proofing efforts are dependent on political support and a respected, prominent leader. As highlighted in Ch. 2 leadership is important for promoting innovative ideas and establishing environmental programs. A prominent leader can also generate confidence and trust and represent the case in the public debate and the media. Physically sufficient funding is a crucial issue (Ch. 1.2). The integration of climate issues in other urban planning task as well as private participation in the development can help to reduce costs. Additional financial support can be provided by national government, subnational benefit schemes from the EU or international sources (Ch. 6). A broad collaboration also grants access to previously unavailable resources and expertise to the public bodies, as well as vice versa opening new markets and economic niches in exportable expertise and technology for companies (6.1).

Last but not least monitoring is an essential step to assess performance against the plans and feed-back lessons learnt into policy, conceptual and detail plans (4.2). A lack of baseline data and unclear responsibilities for the evaluation make a systematic evaluation of performance difficult. So follow-up of results should be planned as part of the goal setting process, where the necessary baseline data as well as the responsibilities for goal monitoring and the feedback process can be determined (Ch. 4.2). Monitoring and feedback into the planning process are the key to changing from a reactive to a reflexive planning paradigm. This allows flexibility to accommodate changing circumstances (van Slobbe et al. 2013) and to eliminate weaknesses identified from monitoring. Even more important this reflexive planning can handle the high degree of uncertainty on the extent of climate change impacts.

(2) How can participation and collaborative approach to vision building and policy formulation help to open windows of opportunity and deal with the most pressing issues?

Vision building is considered a crucial step in the planning process. The approach chosen to build the vision can already alter outcome and reception of the vision (Ch. 1.3). Visions can also make use of the possibility to alter the behavior of residents through the provision of information or incentives. Early vision building secures the full integration of climate related considerations into urban planning. Visions communicate the goals of the project internally and externally (Ch. 4.2). A collaborative approach involving all relevant stakeholders and their collaboration on formulating the vision can encourage involved actors to develop new technological solutions generate political consensus and gather a broad stakeholder participation. A broad stakeholder participation helps solving knowledge and resource based problems (Ch. 4.1). The stakeholder participation and commitment determine the availability of know-how and resources. A broader stakeholder consortium with more perspectives and ideas can gain a more holistic understanding of the challenges and produce the richer and more inclusive solutions. Regarding funding private stakeholders, e.g. developers and housing companies, can shoulder part of the necessary investments as shareholders. Public participation can alter residents behaviour through the provision of information and thus increase the mitigative capacity (Ch. 7.2). Participation and commitment can be supported through their involvement during vision building, through the promise of reputational or economic benefits, a collaborative planning style or strong local bonds. Collaboration is the key to bring together the diverse interests and capacities of the different stakeholders. Plan performance and stakeholder compliance and commitment depend on it. Collaborative policy formulation can also help to overcome the gridlocked policy paradigms (Ch. 7.3). A broad participation and an early collaborative vision building can help to bridge political differences, build consensus, generate political and public support and raise broad participation in a local stakeholder coalition.

(3) Drawing on the review of known barriers to mitigation and adaptation efforts (Ch. 1.2) which factors and strategies were specifically employed to overcome these barriers in the two case studies?

A worldwide study revealed the most pressing challenges (Ch. 2) in 2012. 16 major concerns were identified. The core issues revolved around insufficient funding, gaining commitment, raising awareness and collecting, respectively accessing, necessary information. Fragmentation of urban governance and a widespread lack of interdisciplinary or –departmental cooperation are additional challenges.

In Rotterdam and Stockholm different conceptual approaches with similar tools and instruments were applied.

In Rotterdam a mix of mitigation-adaptation strategy was employed. This strategy stayed overall within the pre-existing linear metabolism model, so there was no confrontation with the path dependent policy paradigm. So emissions and resource demand are realized through increasing efficiency and application of CCS technology as new business branch (Ch. 4.1). Businesses had already engaged in local governance through participation in the city's international and economic advisory board (Ch. 6.1). On the hand this allowed private companies to exercise a great deal of influence on the local government on the other hand this involvement resulted in strong bonds and a high commitment to the city's development and thriving. This kind of public private partnership might be suited for cases where sustainability or adaptation hasn't been mainstreamed yet. A good inclusion of private actors during vision building, knowledge building, technological solutions choice phase and planning has resulted in very good private stakeholder participation to the climate proofing process (Ch. 7.1). Not just the collaboration among public and private stakeholders, but also with scientific institutions for research and development worked quite well to gain commitment, raise awareness among decision makers and planners, generate the necessary knowledge and establish interdisciplinary and –departmental exchange and cooperation. These processes were managed by a coordinating body (RCI) that served to connect and coordinate the multiple stakeholders, served as a common conceptual development platform and was part of the internal knowledge exchange by centrally collecting and distributing information to the involved stakeholders. Overall the climate strategy relied rather on structural measures, e.g. flood protection, integrated in other urban needs for example leisure, e.g. water plazas, than on behavioural changes (Ch. 4.1).

In Stockholm mitigation efforts served to adapt to population growth (Ch. 4.2) and reduce resource based geo-political dependencies (Ch. 1.1). One challenge was the proposed change from a linear to a circular urban metabolism model. Beneficial was the already existing professional and public discourse on sustainability and the society's high degree of awareness and commitment to it (Ch. 4.2). Coherently to some extent the necessary knowledge and know how was already existent, e.g. the vacuum garbage collection system (Ch. 5.2). Information provision helped to alter residents daily travel behaviour. Funding issues could be addressed through mainstreaming sustainability requirements in the development of a new urban district (Ch. 4.2). Furthermore the city was owner of the developing land. So they could entrench the application of land with specific development requirements and duties. This way a major part of investments was carried by private developers.

Vision building, mainstreaming, an integrated planning approach, a good stakeholder collaboration and initial city leadership were common instruments in Rotterdam and Stockholm to overcome barriers to mitigation and adaptation efforts. For the complete list on essential success factors identified see tab. X (Ch. 7.3).

- In Stockholm the developers involvement in the vision building process soothed right wing politicians concerns and thus created political consensus (Ch. 4.2). In Rotterdam common vision building led to a high participation of local businesses and research institutions in the climate proof program and its implementation. The private involvement also encouraged local companies to develop innovative technological solutions (Ch. 4.1).
- In both cases interdepartmental integration of urban planning tasks and issues increased cooperation and knowledge exchange between departments that were rivals for limited public resources before (Ch. 6).
- Additionally cost and a lack of cooperation were addressed by the integration of climate issues into urban planning, either structurally, e.g. vacuum waste collection and public transport (Ch. 7.2), or specifically, such as water plazas and floating houses (Ch. 7.1). Integration should not be limited to the content of the plan, but also integrated into the planning process. It allows for improved cooperation between stakeholders and also for interdepartmental innovations in technology and management
- As part of the concepts' environmental performance was dependent on resident's behavior, the city altered that by providing information to residents or setting incentives allowing for a clear connection between resident behavior and cost savings to be made. Information centers can also be used for marketing of environmental and systems technologies and urban planning. Two good examples from Stockholm were the reduction of unwanted substances in the water and the increased use of public transport (Ch. 4.2).

The above mentioned vision building, participation and mainstreaming efforts resulted in a very good stakeholder collaboration, that was key success factor in both cases. Before this broad collaboration was established, in both cases initial city leadership was very helpful to set up initial funding, provide office space and staff hours. This eased the emergence of environmental urban development as a topic considerably.

To conclude once the window of opportunity through an external igniting spark is recognized the local government can support the emergence of an adaptive concept, encourage vision building as early as the technical solutions choice phase, based on broad stakeholder consultation. Coherent with the holistic vision an integrated planning approach should be chosen. To use a maximum of available capacities and resources a coordinating body should be established to manage the complex planning and implementation process. For tailoring optimal solutions to individual problems knowledge transfer from existing case studies will gain importance as more knowledge becomes available. Although the importance of public consultation during the conceptual phase has not been proved, public participation and awareness are key element to implementing holistic, sustainable urban developments.

Monitoring is a key element for assessing a projects performance and efficiency. Responsibility and necessary data collection should be established early-on in the planning process.

Overall the applied case study method proved to be a suitable approach to extract success factors for climate policy formulation and –planning. The in-depth case studies gave good insight into local conditions, issues and innovative coping strategies to overcome the known barriers. Furthermore the case studies revealed tailor-made solutions to special local circumstances and local solutions to global problems. As there is no generally valid set of tools and strategies to use, but actions are context dependent, a range of case studies on innovative solutions under different circumstances could be the best bet for a global transfer of knowledge on pilot projects and best-practice demonstrations, despite worldwide differing local circumstances and requirements.

Throughout the research it became apparent that the practical application tools and strategies to address climate changes is globally perceived as problematic. Additional research on practicable solutions and innovative strategies to overcome the resource, commitment, communication and information related barriers is necessary.

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Annex 1

Transcription of interviews

Rotterdam

(1) Transcription Interview Rotterdam_emergence

Interviewee: Ingrid van Hanswijk Pennink (process manager to the EDBR)

Who introduced the concept of adaptation into the public debate?

What happens whenever we do an international advisory board conference. It used to be every year, annually. It's now every other year. We sit down with our mayor and our older men, our municipal executives. And we ask them, mostly the older men for economics and port related matters and the mayor which subjects they would like to see discussed at the IAB. Secondly we ask the chairman of the IAB which subjects he would like to see. [...] So based on their issues [...] we will put a program together. In 2006 Rotterdam joined the CCI. Therefore our environment and our transition to being a more CO² friendly city and be more energy saving started with becoming one of the CCI cities. Because it happened in 2006 it was very high on the agenda with everyone. We've joined this initiative, but how are we going to make this happen. We've set certain targets, how do we get to those targets. Therefore it was a subject for the IAB to look at. Also because it happened to be one those things [...] many other cities were looking into at the same issue at the time. So we had a lot of comparison material. [...] That's pretty much what the IAB does. They take knowledge from other parts of the world and bring it to our table. The IAB was the group of people that recommended the establishment of the RCI. Saying if you want to reach these targets, then you need to have a body, an organization that will work towards getting those targets, bring all the different groups of people together at the table.

Would you say that the adaptive concept was the means or the end to the redevelopment in Rotterdam?

I think that was s.th. the IAB at least said: if you choose this direction than that can be a spin off you can make money doing this, become more attractive as a city doing this. You need to change anyways. Because you can't continue on the road you are going on. Which is why we joined the CCI, we don't want to be a filthy industrial city in the 21st century. You want to change. How do you go about doing that? Does it just cost money, is it just fashionable or do you do it for other means. Round about the same time it became obvious that the port was going to have to change in the coming decades. If you follow the trends in the world you know being a large chemical port, an oil port and a gas port. Those things are gonna change and it takes decades to change that. It's gonna start at the same time. But we did look very much at the business case. If we are going to do this it is going to have to benefit us. It's going to have to make the city more attractive. It's going to indeed do things in the sense of attracting congresses, conferences, tourists, establishing companies here, driving innovation... It has to be a full transition. It can't just be token gestures. [...] It has to be a way of life, a chosen direction.

But what was the hook for starting the adaptation process – the sustainability perspective, economic redevelopment ... ?

I think it was both at the same time. It was both finding a new direction, looking at the trends in the world and realizing that we had to change direction at some point. While at the same time

realizing as an industrial port city we have a certain image of being filthy, dirty old fashioned. Which is an image that we wanted to change. It was very much a coming together at a certain point of various different ideas that sort of moved into the same direction. It was just one of those serendipity events. It was the CCI, it was other European cities looking at this concept, it was Richard Floridan his creative class, it was noticing the trends in the world, it was our old economy becoming old and various different people looking at those things and saying: why don't we look at doing it differently. So it wasn't just one decision by one person. It was really a coming together of various different ideas and sentiments and trends at the time.

[...] It has to be a broader movement because otherwise it won't work. Everybody has to get the same idea and get the same buzz and the same energy. We did have that energy. But even with that energy it's been very slow going. It's very difficult to bring about. Although we have done an awful lot of things as Rotterdam we still believe we can do better.

Were the adaptation efforts supported by national and international regulations?

Didn't. I don't think so. Not for us anyway not from the IAB point of view. It could very well be that once the idea was launched that from the local government point of view they did approach various different EU funds or national funds to try and get some funding organized. Or get a few regulations sorted. It wasn't the driving force. It wasn't the fact that EU regulations or national regulations or funding played a part in that.

We had to comply with the existing directives anyways we didn't really have to change ourselves into a green city in order to comply. And again the port. There are so many rules and regulations the port has to comply with which is why we have our own environmental agency that keeps an eye on emissions, noise and pollution. That's where people who live here go to if there is a problem with noise or emissions. They look after our airport and our port. There are an awful lot of rules we have to comply with anyways. We didn't necessarily have to group that with becoming an ecologically friendly city or lowering our CO2 emissions more than those regulations asked us to. Or our green roof policy. Or our water deposit system. We didn't have to do any of those things. Although the water deposit systems came about, because otherwise every time there is too much rain we would get flooded. It's one of those things you need to do anyway. But it fits into the direction that we want to go into.

Did citizens initiatives or other societal drivers, e.g. NGOs have an impact for the emergence of the adaptation concept?

Not that I know. [...]

In what way was it difficult to introduce the concept –what were the main obstacles – who were the main opponents?

I think obstacles are time and ambition. Finance is part of it, but time and ambition! Our ambitions are very high. We want to achieve an awful lot in a short period of time. For which you need a lot of various different companies, bodies, rules and regulations. We meant to move faster than we can. Time and ambition are the constraints. The emissions reduction that we want to achieve. I don't think we can achieve it in the time we set ourselves to achieve it. At the same time we don't want to lower our ambitions, because that means that you are taking a step back. We want to keep those ambitions very high. But we kinda know we are not gonna reach them. Because we've got not enough time, there are so many players involved and it costs money. But mostly organization, trying to get the people organized to the point where you can actually make a change. Money isn't that much of an issue. Although in the current climate it is. It is difficult to find investors.

It's hard to believe that there are no serious issues at all.

I don't think that's a problem at all. We are very much a city that gets every single body and company involved. And we consult with them. From the very beginning everybody can input their ideas but also their objections. Because that way we can organize around it. [...] What is an issue is trying to get everyone on the same sheet as far as priorities are concerned. Obviously when you are having an economic crisis people might say the crisis is more important to me at the moment than building another green roof. [...] Or we need to build a road and a road is going to attract more traffic or more CO2 emissions, however we need that road because otherwise the port gets clogged up. It's more a sense of priority and how important everybody think I it is, ... but it is not an issue of people not wanting to.

But Mr van Veelen mentioned a problem with public awareness ...?

Oh sure I would agree with him on that. I am sure that the broader public doesn't really know and care. But at the same time they are not the first people for my organization that we would be talking to. We are talking to the larger companies who are the larger emitters, who are both benefiteres of a greener city and polluters on the other side. They are the ones that make a difference. They are the ones that need to change their behaviour, how they produce, where they are located. They need to work together with other bodies to make this happen. The general public ... whatever. If they are aware and they want to contribute that's great. But we are talking about larger measures, about major changes as to how the port operates or how the port is laid out or which company is located where. Where we put our water, how can we reduce our emissions, where do we put new highways? Those are issues the general public doesn't really care about. Except when there is too many airplanes flying over and they call the environment agency for noise pollution. But other than that ... they don't really care. [...]

[...]

It's very much driven by the government and the port in our case driving this whole transition phase. [...] However in the Netherlands you sit down with the opposition and try to explain that it isn't going to cause them any problems, you are trying away their concern or you come to a compromise. Than it goes ahead anyways. That's how we expanded the port in the first place. Because then you get an awful lot of environment people: 'Ah ja, more port space, but you are going to destroy the ecological balance.' It took a few years of negotiation but in the end you get there.

Did the government support the emergence of the concept?

Not us. It's possible that our local government is getting grants EU- or national funds to drive these changes. [...] It was very much s.th that we decided needed to be done. And we were going to make it happen one way or another.

Was there a specific point in time, e.g. window of opportunity, when the decision to adopt was made or was it a progressing process?

I think 2007 was the window of opportunity because of joining the CCI in 2006. We were invited to join the CCI like all the other cities. I don't know who accepted the invitation or why. But that brought with it the necessity to think about what we were going to do, what we agree to do as a CCI city. So 2007 was our window of opportunity to say if you this initiative and want to make it happen, you are really going to [...] have to make a plan for the next 2, 3, 4 decades of how you are going to achieve this. That's why the RCI came about to act as a coordinator between all the different parties. To try and get this show on the road. They initiate things, the consult with companies and organizations and they monitor what happens in this city, to make sure we achieve our targets.

What role has the CCI played?

Once you say yes to the CCI you sign a contract promising to reach certain targets at a certain time. I don't know what happens if you don't meet the targets. I suppose we report back to the CCI every year and the RCI monitors. They put out a report every year to show what we have or haven't achieved.

Did the CCI share knowledge? [...]

I don't think everybody develops their own solution. I am sure that there is data and research available. You'd actually have to ask RCI, [...]. We only advised on the direction to take. At the same time we have an awful lot of knowledge in this country and in this city in particular when it comes to engineering, water management, dealing with climate changes and when it comes to adaptation we do happen to have a lot of knowledge already. So I think it's more us sharing the knowledge with them then them sharing their knowledge with us. Although I am sure that other cities have come to with really good solutions to questions that we may have used.

How were new stakeholders motivated to join the effort? [...]

Well when we talk our case, the IAB, it's mostly the big boys that we talk to. In our case it's not an effort to motivate them. Because the larger companies are part of our networks, our boards. So we are in regular touch with them anyway. As long as you can show there are opportunities in going this direction and they know this is the way to go anyway. They can't continue going down the old road. It's not that difficult to get people to join in. As long as it doesn't cost more money than it will give them. As long as the cost return on investment is visible on the horizon it's not really an effort. Companies like BP, Shell, Unilever, ... their clients force them to think more green, to become better producers of their products. So they are moving in that direction anyway. Rules and regulations are pushing them in that direction. So it's not that difficult then to carry on that transition.

In Rotterdam it's different. We have a very strong foundation of the larger companies being involved in the city and the port being involved in the city. And the city being involved in the port. We have a very close working relationship, very consultative, very much asking the companies to invest, not just financially, into their city and invest into the attractiveness and liveability and to work with us developing the economy.

Is that a unique factor to Rotterdam?

Yes I think it's a unique factor to Rotterdam. Amsterdam has actually copied our economic development board model. [...] The way we work together in this city with the larger corporations, with the stakeholders, that is very much a Rotterdam thing. Rotterdam is very much a city that belongs to the people and the businesses and the organizations that are here, that are the major stakeholders in everything that happens in this city. Even though the [local] government may be the driving force in our transition they take the other parties that are stakeholders along for the ride.

It gives you access to their expertise their knowledge and because you get them involved in the very beginning they can tell you any problems they might have in compliance. Or anything else they come up against that as a government you don't even think about or see. And you can take that away from the very beginning. The port vision 2030 was very much put together with all the stakeholders. It wasn't s.th the port authority had just decreed from above [...] a very consultative process. Everybody was involved in creating this vision. [...] That is unique to Rotterdam, we are the only city that has an IAB. Aside from the IAB we have the economic development board. They are very involved in the economic development of the city. There is very close bond between our municipal executive and these stakeholders. And these

stakeholders are the universities, the colleges, our research labs, our large companies, our cultural organizations.

Avoiding the compliance problem is very interesting, because you don't fail the targets ... You can fail to meet your targets, because of the difference between time and ambition [...] A consultative process takes time. Complying takes time. Even if you do it at the very beginning of a process. But it generates less problems if you do it in a consultative fashion. [...]

If you involve them in the beginning the problem becomes a shared problem.

It's not just the (local) government wanting s.th. It's not just the rules and regulations from the national government wanting something. It's very much a shared problem.

Was this the key to successful implementation?

I think it's one of the factors that contributes. The fact that we have our own environmental agency, that we have the RCI coordinating everything, the fact that stakeholders are involved from the very beginning and involved and consulted in the entire process and the fact that we are very close together make it that successful in the city. The only thing that we would like to see is that things go a bit faster. [...] If you go through that consultation process of involving everyone it slows down the whole process a little bit, but it makes sure that you are more successful in the long run. That it is far more anchored in the city and that everyone feels responsible for it. [...]

Would you say that idea of the adaptive concept was part of greater, societal, political or economical trend?

Probably. The invitation from the CCI came from a global trend. We looked at global trends where society, industry, rules and regulations were heading and what it meant for our future. I am sure it was a larger trend that prompted us to take action.

A larger political trend?

Maybe not so much political, more an economic trend. And maybe a societal trend, but probably less a political trend ...

[...]

When developing the concept could you make use of other case studies or pilot projects?

No, I looked in general at mostly European cities, because they are mostly comparable to ours. I started to look at the bigger port cities. And they were actually doing very little. [...] The Scandinavian countries were the furthest ahead, followed by Germany. [...] It was still in its infancy everywhere. It was very much a subject on the agenda for everyone. Like Stockholm, Oslo and Copenhagen had quite a bit on their websites. [...] But there wasn't anything tangible, there weren't any pilot projects I could take and say we should do it this way. [...] I was looking at other cities not so much to find pilot projects, but to get the larger sentiment of things. Because the IAB wouldn't advise on which projects to start. They were looking at the macro economic impact and would set a general direction to move into. And it would be up to the RCI to fill in that plans and the details. But I did look at what other cities in Europe are doing and how far along are they?

Was local or historical knowledge used?

Not really, no.

To what extent could you cooperate with scientific research institutions?

Other, than they were members of our board I didn't ask anyone specifically for scientific data. Simply because I did not need it. [...]

Who would you consider the leading partner?

I think there are 3 parties. The RCI being part of the government, the DCMR and the 'Port of Rotterdam' authority work together quite closely. They would be the driving forces the 3 of

them together. The 3 of them together represent the stakeholders. They are in touch with the entire network behind them. All the different companies. There is organizations like Deltalinqs [...]. Port authority would confer with Deltalinqs and Deltalinqs would confer with their members and environmental technology and climate change were very much on their agenda too. We all interlink. But there has to be a coordinating body. In our case that were the DCMR, the RCI and the Port authority. [...]

Are business partners following public leadership or do they show incentive in actively participating and shaping adaptation efforts?

It's a close connection (between the local government and the companies). They are feeding each other. On the other hand companies are being pushed by their customers [...] Companies are pretty much being pushed from both sides. In our case in Rotterdam they are being pushed because they are part of close knit community. And the larger companies are pushed by their customers to become more aware [...]

It makes a difference if they comply or come up with solutions ...

I think they motivate each other. We see that (...) they link with each other and come up with a new method of doing s.th or of co-creating s.th. So they motivate each other to be innovative ...

Is the political-economic network is it all connected to the IAB or external PPPs

Several. We have (several examples). We call them the usual suspects. So they know each other quite well. [...] Our Rotterdam business network is very strong. The stakeholders in Rotterdam are very much connected to the city, they very much care about the cities development. I sometimes get the idea that in other cities for the companies it doesn't really matter where they are located. [...] Whereas in Rotterdam many companies have strong local bonds and have to stay here. Therefore they are strongly rooted in this community.

Thanks a lot.

(2) Transcript Rotterdam implementation

Interviewee: Peter van Heelen (Advisor to the division 'ruimtje en wonen')

How long have you been working for the urban development department?

This year is my 6th year.

Which persons or institutions supported the implementation of the adaptive concept and in what way?

Well we have a separate program in the city of Rotterdam it's called Climate Initiative, which is a program which has been set aside of the current organization to organize climate adaptation for the city of Rotterdam. So the main persons in this program – you already found them such as Molenaar (he) is the manager of this program. Other main persons are council men and women who agreed to give us a budget and assignment to develop an adaptive strategy for the city of Rotterdam.

What were the main obstacles to the implementation, respectively who were the main opponents?

Opponents is finding out how to implement this strategy so the focus has been in the last years on developing more Knowledge on climate change and effects on the City of Rotterdam (CoR), to develop strategies to deal with that. And now we just started to working on implementation. And already we have been investing a lot of time and money in some implementation projects. People are working in urban planning they are main stakeholders and one of the main obstacles there is that we need to explain them very carefully that climate adaptation is not something what is happening over a long term but is also something which should be mainstreamed in urban development processes on a short term. And this is a complicated challenge aiming at creating more awareness of climate adaptation.

Ok so the public is not aware enough yet and has to be prepared some more?

No, not aware at all.

Who or what was the most important source of knowledge for the implementation, e.g. technology, design, ...?

Well, there is a lot of new knowledge on the climate in the CoR itself. So we are working together with the national knowledge program. It's called 'Knowledge for Climate'. Which has funded a lot of science based but also *inaudible* based research projects in Rotterdam. So we have developed a lot of knowledge here in the city ourselves. On this moment there are different universities working for the CoR on several themes. Hopefully they will be able to give more knowledge yet to us. These are sources of information and a lot of information is coming from institutions like universities.

Are they all organized in the RCI or is it all separate connections or is it a network?

No, they are not part of the RCI, they are supporting us and we work closely together with them, as well as some consultancy firms. Some of the universities and consultancy firms, institutions are also members of the board and they advise us on climate adaptation research. They are not directly involved, they are more participating in the projects.

But they are providing knowledge and new technical solutions.

Exactly. They are participating in research projects or implementation projects. But then we hire them based on subsidies or our budget. They did not join the RCI as a stakeholder.

But it's mostly experts from Rotterdam and the Netherlands, not foreign experts?

Yeah, they are mainly experts from the CoR and experts from various universities and institutions. And then mainly the university from New Delph, Wageningen ... [connection lost] [recall]

So it's true that there is lots of knowledge here in the city, embedded knowledge which is city representatives and officials. They know a lot about water structures and water management in the CoR and we combine this local knowledge with more generic knowledge from institutions. Namely the university of Delft, Wageningen and Deltares. And also the Erasmus university in Rotterdam.

To what extent did business partners provide technical knowledge and solutions to the process?

We are working together with firms like Arcadis and Houseguarding, so consultancy firms which brought in also their knowledge on climate adaptation. There has not been really much. A lot of knowledge had to be developed. These firms, they don't have this information yet.

My experience is that for innovation and this kind of innovative research projects we had to rely on universities and institutions and Deltares, e.g..

So there is a close connection between the business firms developing new technologies and the interlinked universities and institutions.

Yeah well that's true it's a very close connection. So we work very close together with some consultancy firms in two directions. So first they help us drawing up the Rotterdam adaptation strategy. Although mainly informations come from universities and institutions. But we also help these consultancy firms at the city in other Delta cities. So we use our city-to-city network to give these consultancy firms like a stepping stone like to enter another area. E.g. Arcadis we helped them a lot when they were working in New York or Jakarta. When I go for a business trip these companies are invited along.

So you say there was an internal knowledge exchange among the parties. Can you tell me a little bit more about how this was organized?

We had different research projects going on. Focussing on five themes of the Rotterdam adaptation strategy. [...] So every team from the Rotterdam adaptation strategy had its own research program. (2 seconds inaudible)... research projects. And the research projects were the moment when the CoR met the world of research. And well it depends on what kind of project you ask, but in my case we had different workshops and group meetings and it worked quite well.

Were the contracting partners motivated to employ new technologies?

Well it depends a bit. But they were eager to join us at first because they had the impression that there was *...*available for research. They had this commercial idea of this kind of research project and it appeared that they had to invest also a part of their money in this project, like 10%. They couldn't make any profit and then participation went a little bit smaller. They participated basically only to have access to information. That's my opinion. It depends a bit on what kind of firms, so large consultancy firms, they wanted to be in this process of knowledge development. Because they knew they could use the information for their own projects. They basically bought themselves into it. And small firms like small landscape architects or urban planning firms, they maybe used small investments to gain a lot of attention for their field of expertise. Well, it paid out to be an interesting strategy for them because some of these architecture firms now could use the innovative projects as a showcase for their work. So there are different ways.

What was the role of the government in planning and implementing the concept?

The government, they provided the subsidies, they come from the national government. But there was not a direct interaction between Rotterdam and the national Government. Actually the subsidy was given through a scientific research committee.

Is there an individual or organization /network that is considered the leader or leading partner by the other stakeholders and the public?

We were the main leading partner in this project.

Did you have available monetary resources? Who provided them?

Subsidy was given by the government. We had some sources from the Council. So we had our own budget. And then there was money coming from other research and innovation projects. Some institutions they had their own budgets for innovative projects. *We could combine them all.* But mainly money is coming from national and city.

To what extent could plans and measures of the adaptation process be implemented?

It depends a little bit on what kind of theme.

Water management.

We were already working on innovative network of urban water management systems. So when it comes to storm water management there are a lot of projects we realized. [1 sec inaudible]... working together on if this quick is [inaudible]. When it comes to flood risk management we still have to start implementation. That also counts for urban heat islands problems. Though we already started with making the city more green and adding more water to *the city*. So you could say that is also part of this strategy. But it depends a bit. Sometimes we already have nice examples of here in the city we can show to delegations or student groups. At some points we still have to start implementation.

What was the key to the successful implementation of the concept?

The key is that we worked together with a lot of stakeholders in the city. A number of institutions, too. The main positive *inaudible* tors, specialist associations and of course water boards. We really tried to invite every stakeholder in the process of adaptation. That's one. I think second is that we are not only focussing on developing a strategy. But already started by doing things, by starting water squares, realizing the floating pavilion, realizing adaptive water management solutions. So on the one hand we have a strategy but we also have some very nice examples that we can show. That is also *1 word*. So both the combination of a strategy and a some *definite* result I think is probably a nice example. What also has been good for the city of Rotterdam that our international image has been changed from – let's say a post-industrial a bit downgraded city to a modern, climate adaptive and green and instructive city. So there is a lot of exposure been given on the theme of climate adaptation. But also *inaudible*, modern, fresh and young, new city which is also good for the image. So we see that some dutch consultancy firms are now moving their offices to Rotterdam. Because the Rotterdam *inaudible* from climate adaptation and delta technology is very strong.

So in terms of urban redevelopment and economic reasons you consider this quite successful?

Yes. But now we have to continue this strategy and we have next year quite a lot of money for investments in the city. In the next years this structure will be cut back. Now the next year or year and a half we have to develop a strategy or an implementation strategy where other stakeholders in the city invest in climate adaptation. So main question: how to mainstream climate adaptation with your urban development processes and other *1 word* here in the city.

What you are hinting is that the climate adaptation concept has been an initiative from the city. Which is not supported by the vast majority of people in Rotterdam?

To do on raising awareness and explaining people that this strategy is maybe not really stating a short term challenge. But it is on the long term a very important challenge. So they see that this is not only a problem but also can be help us to build a more attractive city and it is cost effective. It is not something which constantly costs you a lot of money (8:49) Which can be, if you plan it wisely a cost-effective approach. So this is a lot of raising awareness, *coming* patient. Explaining what we have discovered. Next year will be the focus on that.

Did citizens initiatives or other societal drivers, e.g. NGOs have an impact for the implementation of the adaptation concept?

Yeah they have a very major impact in the sense that they are partners that have to help us realize the strategy. So when we started developing an adaptation strategy we invited those partners. But in that phase, when there is still little knowledge on what is the climate problem. And also what kind measures and strategies we are able to implement. Those stakeholders are not really interested. I mean they still they waited till the notch was there and the strategy was developed. But now we really have to go back to them and try to raise awareness. Also explain what we think is an interesting way to go. And ask them how they could help realizing this strategy. I think they are being involved quite well. Well but e.g. for the social housing association climate change is the least of their priorities. Only when we explained that climate change is also something which effects their properties and their strategic real estate management. Then they are interested. Well then we can start developing strategies together.

So first you have to create a win-win situation and then people are willing to commit.

Exactly.

Were you able to transfer knowledge or expertise from similar case studies and pilot projects?

Well we also in the Netherlands have to stay. We have to have some pilot projects and we are still trying to learn from those pilot projects. And also have some conversation with national levels to ask them to help us by implementing or e.g. helping us with procedures or legislative obstacles. That's also sth we are developing at this moment.

Are business partners following public leadership or do they show incentive in actively participating and shaping adaptation efforts?

Yeah, it is slowly starting. The *pilot*boards are very interested to work together. Because they see that only when they are also participating in this comprehensive strategy they can achieve their goals. So they are really open to cooperate. E.g. in the green roofs program they are participating. *They call on like social housing corp.* They slowly start to understand that climate adaptation also effects their real estate property, their essence. But we also have something which is adapt to climate change which is smart to do. Because it can save you a lot of money in the long term and it helps you to also mainstream your investments with other investments.

How were new stakeholders motivated to join the effort, apart from inviting them and informing about benefits?

No, at the moment there are little new stakeholders involved. That has also to do with the current economical situation in the Netherlands. So there are many stakeholders that argue in times of weak economic growth we are not focussing on something as unconcrete as climate change. So the real estate developers they are really struggling now to survive this crisis. And

they are not interested in climate adaptation too much. Because it does not bring them money in the short term, it's something which is interesting on a long term, but not for them. So we are losing them as stakeholders at the moment. But others may be interested to join. Times are changing, so...

What was the motivation for the city to start the adaptation process?

It's a combination of understanding that climate adaptation is also an interesting emerging economic field. Rotterdam and Rotterdam's five firms are good in that. So this can also be an economical profile. At the same time we understand that climate adaptation is necessary for the city of Rotterdam. Because we are a low-lying, open Delta city. It is combination of understanding that it has also an economical profit as well as there is an urgency to act. [...] We also try to combine climate adaptation with our other main goals by creating a more attractive city by investing also in public space, parks etc. we try to combine different goals of the city and also **assimilate** our investments here in the city.

Stockholm

(3) Transcription interview Stockholm

Interviewee Björn Cederquist (architect and municipal social planner)

Asked about the emergence of the Hammarby concept he referred to another example in the Stockholm area. Skarpnäck, suburb to the south, developed in the 80's, ecological profile. Begin quote. 'It's in the area to think in that way. And during the 90's the energy use is of more importance. [...] As well as the other new areas around the inner city (6 areas). [...]

Who introduced the concept of adaptation into the public debate?

[...] It was from the non-commercial side. We were looking at a man [inaudible] offices, Stian Ammar, who introduced the idea. He was a finance man. He had a lot of money. He sort of moved rather freely. Hehe. A sort of lobby organization, something like that. And then he convinced the politicians in Stockholm to apply.

But was it a struggle at first?

Probably. I don't really know. But we who were employed by the city, we met the idea when they already were for it, both left and right wing were for it. [...] So we had to carry needles 'Olympic 2004' - everyone here - as a sort of raising the temperature. [...]

That was already linked to the Olympics. Did he introduce the concept prior to the Olympics? Or linked to the candidature for the bid?

Linked to it. Absolutely. You mean if they have been discussing it as a theoretical idea before?

Well some cities have certain motivations to adapt, e.g. sense of urgency, SLR, ... Or in Sweden you have a very proactive legislative approach. Since the 80's there have been a lot of laws and regulations regarding ecology, energy use, resource recycling. It could have been the legislations that forced the city to think in a new way.

Hmmm. (not really)

The politicians in the mid 90's, we had a socialistic majority than, were getting more and more interested, especially the right wings, to present Stockholm internationally to put it on the world map. And the Olympics is one thing to reach that goal. At that time they couldn't imagine that building of an eco-city would attract **that** international interest. That is sort of a surprise coming up afterwards. And now they have been supporting the international information [exchange] more than ever before. To put Stockholm on the world map.

Did citizens initiatives or other societal drivers, e.g. NGOs have an impact for the emergence of the adaptation concept?

The only NGO's I can think of is the 'Friends of Nature'. They were rather strong. [...] When we were starting to plan this area. They were opposing. [...] Because in the first plans we didn't take enough care about the green space that was in the area. There was a fight over the 1st part of the plan. [...] They were actually rather happy when they managed to find a small insect that had to be preserved. We were almost not allowed to build. That was in the time when we applied for the Olympics. So that was a rather stressed time. [...gets map...] Within that (1st) plan there was this oak wood forest. The preservation of this was the first fight. The 1st detailed plan took a part of these trees to build houses. And the fight ended up with changing the detailed plan. [...] That's

an expression of the fight between producing new apartments, which was the main interest in the master plan and the environmental values colliding.

Could you transfer knowledge from other pilot projects? Or you already said you looked at Sydney's environmental profile?

That was a motivation when it came to the Olympic application. But we had ecological ideas already before that. As I said Skarpnäck was built in the 80s. And we had an ecological program for building in Stockholm at large, already in the 90s. So the main structure was already there. And the national regulations supported or pointed out all the essential factors.

Was the adaptation process in your city part of a greater societal trend?

Exactly. That's right. When we started here and wanted to impress the Olympic committee we sort of lifted the demands a little bit from the existing national programs. [...]. The handling of water, waste, energy, traffic and building materials were the parts where we had a bit more specified demands.

[...]

The integrated approach is not really new either. In the 80s and the 90s we were talking about ecology all the factors were in. You can't get anywhere with just one separate and one separate, ... In a way the integration was quite natural. What was done here was the illustration of this Hammarby model. But in a way that's more a sort of illustration than new thinking.

The symbio city is more. [...] It's more like packaging a Swedish way of thinking to sell it abroad. The symbio city is not quite a new invention. It's more a compilation of what we had already done in different ways.

Sorry let me rephrase one aspect of that. Are you saying that developing this ecological profile for export was another motivation for starting this?

No. It came up later. The idea with the symbio city was formed in 2006 somewhere on the way. That's more from the national government. They say: 'Ah this is an idea, we could package it and sell it abroad. But that was when it was already clear that Hammarby Sjöstad had drawn this interest. In a way the expression the 'Hammarby model' is not the Hammarby model. It's based upon the larger scale model, because treatment of water is a story of the 40's at least. Where the first large waste water plant was built in the North and the South. The district heating was built out in the 80's in Stockholm and that's a very important part of the ecological model. [...] From the 80's and up the area gets more and more clean in Stockholm. Everything that was built in Stockholm is connected to these systems. [...]

Which persons or institutions supported the implementation of the adaptive concept and in what way?

Implementing the program for building was very much from the city. We are in lead of the project and we are choosing the builders and the developers coming in. And we are making the contracts with them where the demands can be expressed. You negotiate with these developers to elaborate the goals. The main ... the developers were in a way more opposed to the expectations when it comes to energy savings. [...] A few developing firms early saw the value in having local environmental programs within their firms. Some saw this as a competitive advantage. But in the beginning of the 90s that was very weak. [...] It was not looked upon as a very strong factor. Now the developers are taking their own initiatives because they find that it is easier to sell the apartments if they can say that it is environmental friendly. But in the 90s that was too early. [...]

What were the main obstacles to the implementation, respectively who were the main opponents?

We have an environmental authority within the city. Their task is to raise the environmental importance within the city. Sometimes new plans get in collision with the [...] environmental demands. [...] an energy plan [...] they are emitting smoke here. So we had to consider that building the houses. Or the traffic produced too much pollution. At the point we had to go back with the detailed plans here. [...] It's not always that the interests of the project of building a new part of the city is in phase with the environmental values, although we're trying to produce an environmental friendly housing project here. [...] We were trying to keep down the need of private cars. That was a long discussion amongst politicians in the city hall. The right-wings view included a lot of cars. The environmental parties they were for no cars, no parking at all to keep out the cars from the area and a very high standard of the public transportation. [...]

So you could say that in general there is an agreement upon the environmental goals, but regarding the details there is friction between the interested parties.

Exactly. We were introducing the grinders [expl. grinders]. We wanted to introduce that and then the developers the opposed. In the first place the water company opposed [tech expl]. At one point in 2002/2003 when this was an issue it was stopped because of these collisions of interests.

Who or what was the most important source of knowledge?

My impression is that it is rather local. Maybe we sometimes invent the wheel again locally. Maybe we could have imported more. In a way it's a worldwide exchange all the time. We haven't bought technical solutions. In a way it could have been more natural to import more. To be more open [...]. A lot of noise about the vacuum [waste] collection system. As far as I know this is not an imported idea. Maybe it is. But they started in the 80's somewhere. 1981 in a hospital. [...] We haven't imported other technologies. We have used the local, Swedish firm. But they on the other hand have used it as a sort of prestige project to sell their ideas abroad. [...] The developers are all Swedish developers. You could expect at least later-on in the project (developers) from abroad coming in.

In what way did business partners provide technical knowledge and solutions?

I think you can mainly find the developers come in with a solution. Because in our program we are just pointing out expected results. Of course there are informal exchange of ideas. When we meet we point out things [...] The vacuum collection was a demand from the city. [...] What we pointed out, we wanted a more efficient way of collecting the garbage to reduce the amount of traffic in that area. We had this system in other parts of Stockholm before. We had the experience from other areas.

To what extent could you draw on or cooperate with scientific research institutions for design and implementation?

I couldn't think of much. We had contacts underway with the royal technical high school for instance. But that's more when we ask them to make evaluations of different kinds. There are some engineering firms in planning that are connected to the planning of Hammarby Sjöstad. But they had not been in the project lead. They have not been so closely connected to the project. Even those things are coming up afterwards or on the way. Some firms like the waste company are using HS to advertise in the world. E.g. SWECO is a large engineering firm. They have done some smaller projects in HS on one level or another. I think they are using this to sell their firm abroad. And Teng Moses is an architect firm, they are behind the contact with these Chinese examples. It's on the way. It's not from the start actually. What we had in the start was a sort of exchange between Helsinki in Finland and Oslo in Norway and Copenhagen so we were meeting because they had underway areas of the same kind. So we were exchanging ideas about

environmental programs and things like that. But that was also on the public level, the political level. It was not on the market. Especially in the beginning there was a very clear division between the public and the market.

So you could say that externally on a political level you had a knowledge exchange?
Exactly.

But did you also have an internal exchange among the stakeholders?
I think that was more informal because they were competing. They were not that open. If they had something special, I think, they kept it to themselves. I am not quite sure. Of course we have all these very open meetings. To decide on a layout like this. In the first place the city has just a rough idea. And then we decide on the blocks and the developers for the blocks. And then we meet with these developers every month for a year, one year and a half. And exchange the progress in each project. That is a rather transparent exchange. But when it comes down to technical solutions, because this was more on a design level, I think they tried to keep their solutions to themselves.

In the first years we had competitions about energy saving techniques e.g. And then the different developers came in with their solutions In a way that opened up a bit. Then we could judge between them and they had to show what they were doing. We were trying in different ways to open up. But of course they keep their secrets to themselves as long as possible.

What was the role of the local government in planning and implementing the concept?

In the beginning it was very strong because we had the top politicians in the steering group. They followed the program very tightly. Especially starting with the Olympic idea. Sometimes even afterwards when we knew that the Olympics wouldn't come to Stockholm. Because they were interested in the overall idea. It's a rather large development area if you compare it to other development areas in Stockholm its 24.000 inhabitants in the end maybe 30.000. They could have paid time on the project and followed it rather closely. Let's say for four years. From 1996 to 2000. And that made the governmental influence rather strong. But then the project slowly has become more traditional. The lead of the project is within the traditional way of implementing things. There are prestige areas around the inner city. In a way the politicians pay a lot of interest to the Royal Seaport. In the others less [...]. In the 90's Hammarby was absolutely the top. We didn't have that sort of direct governmental influence in the project.

Is there an individual or organization /network that is considered the leader or leading partner by the other stakeholders and the public?

All the developers they had associations too. At one critical moment in 2001 when the sale of the apartments were actually stopped nobody was interested in Hammarby Sjöstad. The developers had produced large parts and there were problems to sell. And at that time the developers organization and the city shook hands. And decided to have a large exhibition here to raise the interest in Hammarby Sjöstad and show the qualities . At that time the developers organization was a very important part to cooperate with. Otherwise the strong organizations ... the water company, the energy organization, the transport organization and within the governmental organization the regional transport administration was also really strong. But I can't point one part out that is the main co-operator.

What about the city?

Well the city is the main actor absolutely. From the beginning that's the initiative we owned the land or we got hold of the land. So from the start we had control over the real estate. The city is absolutely the main actor. I thought you were asking who the city cooperated with.

Who provided the monetary resources?

If you look back the city has invested 15 % and 85% is private investments. That is mainly developers but also the companies around – the energy company, the water company. They are on the market anyways. The handling of waste is still inside the city, it's public. Three of the developers are public, they are publically owned housing companies. But the rest that is 30 developers they are private.

To what extent could plans be implemented?

The goals in the beginning everything should be double as good as other areas from that time.

Which was extremely high. A way of politically expressing things. But if you look at the energy consumption we came not down to 50%, maybe 75% of the initial level. So we got down from 200kWh/m² to 120-130kWh/m². Now there are examples coming down to 50-60 kWh, that's almost one third of the situation in the mid-nineties. If you look at traffic. The use of public transport here it's the same as in the inner city. It's 80% public transport and 20% private cars. It's not extreme. It's coming down to the same as the inner city [...]. You can't really point this area out when you compare it to others, because the progress is going on everywhere. We are collecting the organic waste in all the areas in Stockholm now.

In relation it's hard to say how far Hammarby has succeeded. But if you look at the original plans, would you say most has been accomplished or did you have to make cuts?

Cuts, absolutely cuts. With energy, in a way with traffic. We should have been, we could have been better than the inner city. The inhabitants showed to be a very high income group. They can afford [...] consuming a lot. [...] They consume quite a lot. It's not a small footprint. [...] But they are very aware of course. And the information is there all the time about the energy. People are very aware in Stockholm. Especially the middle class and the upper middle class. But then when it comes to your own lifestyle its typical 'nimbyism'. [...] In that respect we haven't succeeded as far as we liked to. It's a contradiction since the city is investing and leading this area into very high quality area than it attracts a sort of people coming in. Than the level of private investment, lifestyle is naturally going up. In the city it's also more exclusive like this. The gap in Stockholm is growing. When I grew up in the inner city 50 years ago it was a real mixtures, all lifestyles, poor and rich. But now it's completely segregated you find the poor people in the very far away suburbs. In a way this could be a political issue. [...]

You could use the 3 public housing companies [...] to make it possible for people with low income to live in the area. You could subsidize it quite a lot. But then of course you have to be in very strong control so that its reaching the target groups. [...]

I have had groups from Holland, England ... who say we have much stronger social housing. High quality housing at a low price. And it really works they said. They are a bit surprised that we are not using our publicly owned companies for that reason. Because that's what they were started for in the 40's and the 50's.

What was the key to the successful implementation?

In this case its because The city as one hand having complete control or had a vision that was kept up for the whole area. Things are not just popping up. It's step by step, an overarching concept. In the start having control of the land, choosing the developers controlling the investments in the area. But it's also that we live in a country with a lot of regulations that are really working. The situation in Sweden, Stockholm makes it possible.

Would you say it's a combination of a broader societal movement and the strong central position of the municipality in directing growth and development.

That's right that are the main sources, the main factors behind the completion of it. [...]

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