Urban Climate Governance

The Role of Local Authorities

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Thesis

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Motivations and Acknowledgements

"A good city is like a good party. You know it's working when people stay for much longer than really necessary, because they are enjoying themselves."

- Danish Architect and Urban Planner, Jan Gehl

As a child I was uninterested in cities, wanting to spend all my time in nature: hiking a winding mountain trail, swimming in a glacier-fed lake, or exploring a forest of moss-covered trees. In my childmind, cities were equivalent to suburbia, which I loathed. I cried when a cookie-cutter like development would eat up the natural places I loved. I found no mystery or creativity in these spaces: houses with matching doorframes and perfectly manicured, chemically induced lawns. They lacked spaces for exploration or imagination. But I was lucky. I grew up in the U.S., but my family travelled often, especially to Europe to visit family. From an early age, comparing and contrasting living environments became status quo. Historical cities fascinated me: I would touch ancient stone buildings, damp with history and mystery. We sat in cosy cafés with low ceilings and smoky fireplaces, or alongside rivers or canals – the endpoints of the glacier streams I adored. I would observe: watching how people interacted in and with these spaces. I began to love these cities as much as my wild spaces. I remember thinking: *why are European cities so much more beautiful than U.S. cities*? Boiling it down to history was too easy. U.S. cities have *some* history. Then it dawned on me: *parking lots*. Instead of market squares filled with fountains, vendors or public spectacles, U.S. cities were filled with cars. Instead of the narrow winding streets of central Barcelona or Stockholm begging to be explored, U.S. cities prioritised wide arterials for vehicular convenience. Undoubtedly this is far too simplistic. But then, these were the ponderings of a childmind.

In a roundabout way, these early thoughts influenced the environmentalist and urbanist I would become: an *environmentalist* to protect the natural spaces I adored, an *urbanist* to attain this childlike wonder in a city. I have learned how natural landscapes shape our cities and how our cities shape natural landscapes. When I see a city, I do not merely see buildings; I see the people who have lived and interacted there over the years, the centuries. I do not see parks; I see places for exploration or celebration, where tiny creatures grow, birds migrate or children create. I do not see roads; I see places to walk, run, cycle or play. I imagine cities as people, as mentors and muses: Malmö is the girl with a troubled past, but a bright future; Rotterdam has an entrepreneurial soul; Amsterdam is a confident trendsetter. I don't live in a city, I interact with it – and in my muse cities this is most appropriately done by bike. I'm a lover of bicycles, a hater of parking lots and I've quoted Joni Mitchell more times than I can remember. "*They paved paradise, and put up a parking lot…"*

Still, it's not enough to hate the parking lots, especially when the car remains a nasty necessity. Referring to the car as a mother-in-law, Jaime Lerner, former mayor of Curitiba (Brazil) put it best, *"You have to have a good relationship with her; but she cannot command your life…"*

It's about balance.

Almost 20 years later, I'm thankful my childhood ponderings led to a career field of which I am deeply passionate about: sustainable urban development, and to this dissertation project on climate change strategies in cities. Turning one's passions into a career isn't easy. I'm utterly thankful and indebted to my amazing (and patient) mentors, supervisors, friends and family, who have sat with me for endless hours: challenging me, encouraging me and inspiring me, as I attempted to turn my passion into something articulate. As someone who has lived in some 20 cities in eight countries – a self-proclaimed *cosmopolitan nomad* – finding a sense of community has always been a high priority. And here I have been extremely blessed. This thesis is the end product of a process that started long before the years in Wageningen, and hopefully one that will continue.

To my MSc community, "the MESPOM family" in Lund, Budapest, Lesvos and across the globe: I am forever indebted to professors, colleagues and friends associated to this programme. We have different professional and cultural backgrounds, different passports and career tracks, but via MESPOM a common identity and ambition. Specifically, I would like to thank Aleh Cherp for teaching students not just academic topics, but to live with conviction and integrity. There are many persons associated to MESPOM/IIIEE to acknowledge, notably: Håkan Rodhe for his energy and enthusiasm, Lars Hansson for building a strong sense of community, and my former MSc supervisor, Naoko Tojo, who was a key motivator for my own pursuit of a PhD.

That being said, I didn't pursue a PhD right away. I would thus like to thank my colleagues at Malmö's City Planning Office and Environment Department. Malmö has a motto: *to make sustainability reality.* I continue to derive inspiration from this city, and former colleagues who work unceasingly to improve upon this quest – in Malmö and via city partnerships across the globe. It was in Malmö that the big messy problem of climate change became tangible in the city: in the form of bike lanes, green roofs or solar panels. I will never forget the *Eurocities Environment Forum* cocktail, held at Malmö's coastal education centre, when European city politicians and civil servants dawned full-body fishing gear (atop business suits) and stepped out into the sea to learn about the aquatic environment, because *"if climate change will bring the sea closer to us, then we should learn how to better interact with our surrounding coastal environment…"*

Specifically I would like to recognise Malmö's former mayor, Ilmar Reepalu, whose tireless efforts and persistence helped Malmö transition from its industrial past to a sustainable future. Of course Malmö still has many hurtles to cross. Nonetheless its transition offers hope: to believe in the impossible until it is not just possible, but slowly becomes reality.

To place the urban sustainability agenda in a global context, I spent six months at UN-Habitat's Urban Environmental Planning Branch in Nairobi, assisting the launch of the *Cities and Climate Change Initiative*. Nairobi conjures up memories of matatus, safaris, the Youth Empowerment Programme in Mathare Slum, and my "Home 51" housemates. And foremost, my two supervisors with whom I remain in contact with and am deeply indebted to: Marco Keiner (of UNECE) and Raf Tuts (of UN-Habitat).

It was in coming to Wageningen's *Environmental Policy Group*, that I could step back and analyse urban climate governance from a scientific point of view. PhD life has been a challenge and a valuable opportunity, enriched by personal and professional opportunities to learn, build networks and build communities. Admittedly, I've had a unique supervision experience, largely due to supervisors transferring countries and institutions. Nonetheless, each offered insights for my PhD and broader topic understanding. To Kristine Kern: for convincing me to come to ENP, and for initial discussions on urban climate governance. To Sofie Bouteliger: for your role as friend and supervisor, and for helping me structure, and thus articulate, my research. To Gert Spaargaren: for my new appreciation of social theory. To Grietje Zeeman: for a focus on technical systems and circular thinking. To Dave Huitema: for discussions on adaptive governance during my short stay at IVM. And to those with whom I have worked the longest, to Arthur Mol: I'm eternally grateful and fascinated by how you balance so many students, papers, theoretical contributions, managerial and editorial responsibilities, while appearing cool and collected and with five minutes to spare for a spontaneous coffee or a chat. I cannot think of anyone better to serve as Wageningen's new *Rector Magnificus* and am excited for what this means for WUR. And to Bas van Vliet: for taking me on (a few supervisors in) and jumping in with full gusto, for your patience, for reading endless paper drafts, for the chance to supervise MSc students together, and for always having an open door to discuss theory, empirical findings, or personal struggles and triumphs. It has been an absolute pleasure.

To the international, dynamic and supportive ENP PhD '+' community: I think fondly of tasty eclectic dinners, of graduation parties, and of ENP PhD trips to Sweden/ Denmark and Belgium. To those who graduated or moved on: Aisa, Ali, Carolina, Chaohui, Dorien, Christine, Dan, Elisabeth, Fredrick, Imke, Jia, Judith, Kim Ching, Leah, Maria, Megan, Wenling and *the boss*, Sammy. And to those still around to discuss theory, deadlines, or forget about it with a spontaneous beer: Alexey, Belay, Eira, Elena,

Debasish, Harry, Hilde, Ingrid, Joyde, Judith, Jillian, Joeri, Kari, Mairon, Mattijs, Martijn, Linde, Marjanneke, Natapol, Robin and Tracey. From you I learned about urban sanitation and waste management in East Africa, fisheries governance in Asia and the Pacific, REDD+, and sustainable tourism in the Artic and Caribbean.

There are a few ENPers I would like to thank specifically. To Corry: for being the go-to woman for every possible ENP question and always having the right answer, *and* for fresh eggs! To Dorien: for making ENP home right from the start, and for revealing that outdoor adventures exist in the Netherlands, notably our lovely rainy tent-free overnight in the Veluwe last February. To Carolina: for bringing flair to any ENP lecture or event, and the Brazilian flag to PhD barbeques. To Jia: for joining the Amsterdam garden and our Stockholm walks. To Kari: for offering your home for PhD dinners or as a cosy guesthouse in Wageningen, and the chance to speak Swedish. To Sarah and Jillian: my lovely officemates and fellow Amsterdam commuters, I am happy I got to start and finish my PhD with one of you close by! To Joyde and Ingrid: I have enjoyed our work on Curitiba and hopefully beyond… and for your listening ears when other topics occupied my thoughts. To Hilde, Imke and Linde: for learning web and social media skills together, I feel so much savvier! To Megan and Ali: for your topic enthusiasm and dedication, which was wonderfully contagious. And, to the MSc students I had the pleasure to work with in the classroom and as a supervisor, especially Renske, Maria, Kim, Christiaan and Caro: from you I learned through teaching, while gaining new insights on Dutch local climate governance, greening neighbourhoods, urban agriculture in Santiago and Amsterdam, and emerging cycling trends in Ecuadorian cities. It was fun to call you "my students" but even more so to call you my friends.

My PhD was enriched via participation in several research communities, notably the *Dutch SENSE Research School on Environmental and Sustainability*. SENSE provided a platform to develop personal and professional contacts with colleagues in Utrecht, at IVM/VU and UvA in Amsterdam, and Groningen. To Merrin: I think fondly on our Swiss ski trip, and the parties and laughs before and after… I miss you, but I WILL visit New Zealand! To Carina: I loved planning the SENSE workshop together with Alex, and always smile thinking of our sneaky "entrance" to that PhD party in Utrecht, creaking doors and all. To Eleni, Philipp and the IVM crew: the Georgian ski trip (with a crazy group of Spartans and Romans) was a highlight, combining mountains, bathhouses, cultural sights and local wine and cuisine. I already look forward to a reunion ski. Outside the Netherlands, *stór takk* goes to the *NORD-STAR Network on Strategic Adaptation Research*: for giving my PhD a distinctly Nordic touch, for summer schools in Reykjavik, and for colleagues who became friends in Sweden, Denmark, Norway and Iceland, especially Bryndis, Gregor, Lottan and Nina. To Nina: I can't wait for our post PhD hiking adventure!

Alongside the PhD, I've been fortunate to write for *IISD's Reporting Service/ Earth Negotiations Bulletin.* Covering multilateral environmental agreements and other international fora from a non-partisan point of view has undoubtedly enriched my research and broader understanding of complex global environmental issues, including how such issues interact. Aside from the insights, I benefitted immensely from the ENB community, many who became good friends.

To non-PhD communities in Amsterdam, notably the *Curious Finch Educational Garden*, and the climbing community: thanks to you, I've had the pleasure to use my hands and feet: in the soil and on the wall. To *U.S. Democrats Abroad, Netherlands chapter*: to be reminded that we live in a global system with repercussions beyond national boarders – relevant for geopolitics, and also climate change.

I am very excited that two of my best friends and fellow cosmopolitan nomads will stand by my side, as "academic bridesmaids" (*paranymphs*) for my defence, taking time away from their busy schedules to stand by me. I can't tell you how much this means. To Rina, my lovely, crazy, adventurous friend of multiple passports and even more cultures: how fitting that we met 10+ years ago, both late to the same political science course in Uppsala… I'm so happy that we decided to walk into that classroom in solidarity, and also through life: climbing mountains, skiing down them, discussing literature or intercultural relations, pondering the meaning of "home" while thinking fondly of the Pacific Northwest, and always being the last to leave the dance floor. To Tahia, my MESPOM partner in crime, my former housemate, my very own Pachamama, my forever friend: from you I learned Bolivian dance and Belgian hospitality, how to store GIS files in a carpet or conduct an EIA, while getting to know Central and Eastern Europe by bike, foot, scuba gear, skis or (running for) the train. My life is fully enriched by you both: you have been my motivation, my inspiration, my fellow PhD nerds, and equally, my laughter and support.

To my Seattle friends and family, especially my sister Ann Marie: I loved growing up with you, moving from place to place. As children, we were so different, but learned and laughed together. As adults, I'm thankful our passions, while coming from different perspectives, share similar end goals. I continue to learn from you and I am so impressed by the woman of integrity and conviction you have become. To Ross, and especially my sweet nephew Hank: you are my motivation to tackle complex challenges like climate change; you are a reason to believe in that impossible. Finally to my wonderful parents, Margareta and Craig: you are my foundation, my motivation; you are my greatest heroes. This thesis is for you. Thanks to your strong and unwavering support behind me, I was (and am) able to accomplish this feat and boldly trudge towards the next one. You are my rock; I am beyond blessed.

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List of Abbreviations

AMICA	Adaptation and Mitigation - an Integrated Climate Policy Approach
BANS	Bestuursakkoord Nieuwe Stijl (Dutch Subsidy: New Style Management Agreement)
CCI	Clinton Climate Initiative
CHP	Combined Heat and Power
COP	Conference of the Parties
CO2	Carbon Dioxide
C40	C40 Cities Climate Leadership Group
EEA	European Environment Agency
EPA	Environmental Protection Agency
EU	European Union
FAO	Food and Agricultural Organisation
GHG	Greenhouse Gases
GRaBS	Green and Blue Space Adaptation for Urban Areas and Eco-Towns
ICLEI	Local Governments for Sustainability
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IISD	International Institute for Sustainable Development
INES	Industrial Ecosystem
IUCN	International Union for the Conservation of Nature
LIP	Lokala investeringsprogrammen (Swedish Subsidy: Local Investment Programme)
KLIMP	Klimatinvesteringsprogrammet (Swedish Subsidy: Climate Investment Programme)
MUSIC	Mitigation in Urban Areas
NGO	Non-Governmental Organisation
NPM	New Public Management
OECD	Organization for Economic Cooperation and Development
PPP	Public Private Partnership
REAP	Rotterdam Energy Approach and Planning
RCI	Rotterdam Climate Initiative
SEK	Svenska Kronor (Swedish currency)
SLOK	Stimulering LOkale Klimaatinitiatieven (Dutch Subsidy: Promotion of Local Climate Initiatives)
SKL	Sveriges Kommuner och Landsting (Swedish Association of Local Authorities and Regions)
UHI	Urban Heat Island
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
UN-Habitat	United Nations Human Settlements Programme
VNG	Vereniging van Nederlandse Gemeenten (Association of Dutch Municipalities)
WWF	World Wide Fund For Nature

1

Introduction



1. Introduction

"Cities are central in tackling climate change. They are proving grounds for our efforts in ensuring a low carbon future that benefits people and the planet."

- United Nations Secretary General Ban Ki-moon, at Cities Day COP19 Warsaw

1.1 Addressing Climate Change in Cities: Lessons from the Dutch

In 2010, the City of Rotterdam and partners hosted a conference entitled *Deltas in Times of Climate Change.* Scientists, policymakers and practitioners travelled to this delta city to learn about Dutch water management and coastal protection schemes, and to discuss climate adaptation strategies on how to "climate proof" cities. Rotterdam, a recognised leader in urban climate adaptation (as well as mitigation), shared its experiences with representatives of other low-lying delta cities such as Jakarta, Hong Kong, Ho Chi Minh, New Orleans and New York. After all, while climate change brings new and escalating challenges to this seaside city on a river delta largely below sea level, battling the water is nothing new – not in Rotterdam, nor any Dutch city for the matter. In a country where 50% of the landmass is circa a meter (or less) above sea level, the Dutch have long been a resilient people in the face of rising tides, designing their country – and their cities – to withstand, or even benefit from, an otherwise swampy situation. The canals of Amsterdam, Delft or Utrecht facilitate trade and transport, while redirecting water to reduce possible flooding. It's not only Dutch geography that has been shaped and reshaped by this watery relationship, but also politics. The Dutch are famous for their "polder model" of consensus-based decision making, crucial when deciding whose feet will stay dry, or whose farmlands will be returned to the marsh. While climate change brings renewed attention to terms like adaptation and resilience, the meanings behind these concepts are firmly planted in the Dutch culture for survival.

Never were adaptation and resilience measures more relevant than now, with a threat of exacerbated sea level rise due to climate change. The Dutch are not alone in this: circa 50% of global population and three-quarters of all large cities lie within 100 kilometres of the sea (UNEP and UN-Habitat, 2005). Cities are not just likely victims of climate change; they are also contributors – growing exponentially in population, resource consumption and greenhouse gas emissions. Markedly, some of the world's fastest growing cities (e.g. Shanghai, Lagos, Jakarta) straddle coastlines, river deltas or other water bodies; but are ill equipped to adapt to climate change, making them particularly vulnerable. In 2005 *Hurricane Katrina* decimated the U.S.

city of New Orleans. This massive hurricane shocked the U.S. and the world in terms of its magnitude and severity, but perhaps more profoundly, in terms of the genuine unpreparedness of the city, and the U.S. government, to respond adequately to such a catastrophe. While Katrina and other calamitous events cannot be directly attributed to climate change, their increasing frequency and intensity is alarming.

With such events in mind, the Deltas conference was held. Discussions concentrated on how cities can learn from each other to address climate change; how to combine technical measures with policy, planning and awareness; and how to take advantage of the adverse effects of climate change. Rotterdam boasted of innovative adaptation measures: its floating pavilion, its water squares that serve as multifunctional public spaces, its water storage facilities that double as underground parking, and its green roofs and green walls to reduce flooding or to counter urban heat island (UHI) (see Figure 1-1). Despite urban vulnerabilities, the Deltas Conference made it evident that some cities are addressing these issues: often combining climate change planning and policy with measures to address quality of life and sustainable development. Cities contribute to climate change; cities are vulnerable; and increasingly cities act on climate change.

Figure 1-1 Components of Rotterdam's Climate Adaptation Measures
Images sourced from Rotterdam Climate Initiative

Against this background, this dissertation is placed within the current debate on cities and climate change and more specifically the role of local government authorities to address climate change mitigation and adaptation.

The next sections of the Introduction describe the research context and research questions in further detail. Section 1.2 frames the key issues, which provided context for this dissertation's research. Section 1.3 places the research topic in a global perspective, examining the growing recognition in global and regional fora for urban climate actions. Section 1.4 introduces the role of local authorities in the literature on (urban) climate governance. Section 1.5 presents the research problem and research questions. Section 1.6 describes the dissertation's methodology and finally an outline of the dissertation is provided in Section 1.7.

1.2 Framing the Issue

1.2.1 A World of Cities

As the birthplace of civilisation, cities are the cradles of historic political, economic and religious institutions that continue to influence modern society; they are also the home of the associated problems of pollution, disparity and resource consumption. It should come as no surprise then that cities lie at the heart of both the opportunities – and challenges – inherent to modern society. This symbolism is magnified, given current urbanisation trends. Cities thus represent a problem and solution space to address a variety of challenges, including climate change.

Cities worldwide are expanding at unprecedented rates. For the first time in human history, cites are home to over half of global population (UNFPA, 2007; UN-Habitat, 2008). In 1800 less than 3% of global population resided in cities. Following the Industrial Revolution, cities began to expand. In 1900 circa 15% of global population resided in cities, most cities however were small; only 12 had a population over one million (PRP, 2007). In the 100 years since, individual cities and global urban populations have grown exponentially. By 1950 cities housed 30% of global population; by 2008 this increased to 50%, meanwhile rural populations are stagnating or declining (UN, 2005). Projections estimate that by 2050 cities will be home to 65-70% of global population – a majority of this urban growth concentrated in Africa and Asia (PRP, 2007; UN, 2014; see Figure 1-2).

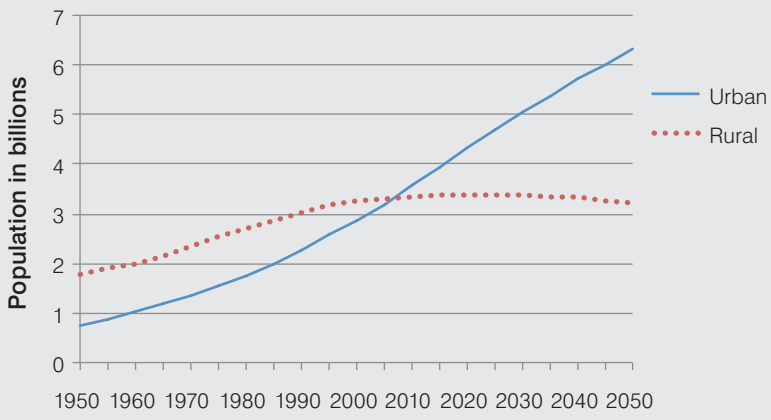

Figure 1-2 Urban and Rural Population Growth as Part of Total Population[1]

1 Source: UN DESA, 2014

People increasingly flock to cities for the opportunities cities provide: for jobs, for educational advancement, for experiences. According to some researchers, denser population concentrations can also lead to greater amounts of human capital and ingenuity. Florida (2008) has dubbed this the rise of a "creative class", wherein cities that foster open and dynamic social and cultural environments attract creative people and businesses, and thus investments. However, not all cities, nor all urban citizens, have equal access to the opportunities cities provide. These opportunities vary considerably across cities and within cities, as do relative income disparities and quality of life[2].

Cities also require vast amounts of resources, including land, water, energy and food. Moreover, the relationship between resources and modern cities has become largely linear: resources from the periphery are consumed in the city, with waste products returned to the periphery (Girardet, 2010). The larger the city, the more it follows this linear pattern. Still, as places where resources physically metabolise, cities offer opportunities to increase efficiency via collective infrastructure (e.g. public transport, district energy) or to close resource-waste cycles by reusing resources locally. In the process they can become more circular or symbiotic cities (Girardet, 2010; Kennedy and Hoornweg, 2012; van Berkel *et al.,* 2009b; see Figure 1-3).

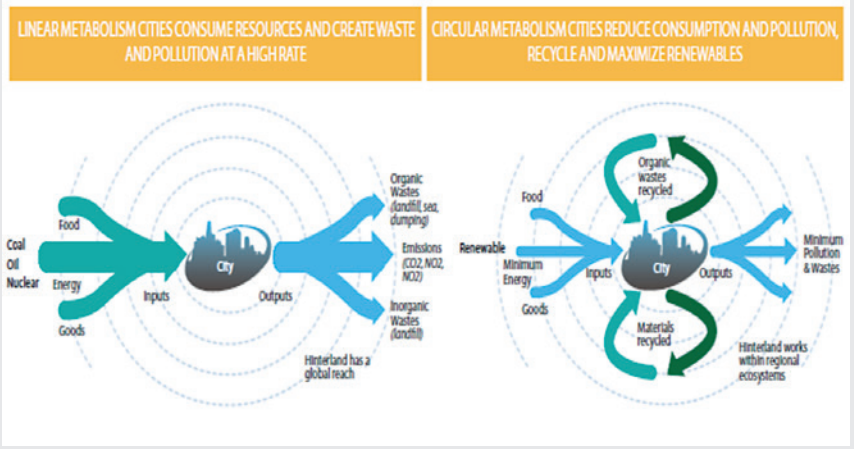

Figure 1-3 Moving towards Cities as Circular Systems[3]

2 UN-Habitat (2011) estimates most urban growth will occur in developing countries, in cities lacking service provision with substandard housing conditions. Globally one-third of urban dwellers reside in slums and informal settlements. This is an urgent issue. However it lies outside of the scope of this research, which mainly examines forerunning cities located in Northern Europe.

3 Sourced from Girardet, 2010

1.2.2 The Climate Crisis

Since the Industrial Revolution, fossil fuel burning (e.g. in energy production, industry, transport) and rapid land-use changes (e.g. deforestation, urbanisation and agricultural conversion) have accelerated the release of greenhouse gas (GHG) emissions into the atmosphere, reducing our planet's natural ability to absorb and sequester emissions, and leading to the intensification of the (otherwise natural) greenhouse effect – resulting in climate change.

According to the Intergovernmental Panel on Climate Change (IPCC), some of the impacts of climate change include: higher average temperatures, sea level rise from melting ice, unpredictable and extreme weather events, and shifts in agricultural productivity (IPCC, 2013; IPCC, 2014). Climate change is not just an environmental issue; it will have long-term consequences for social and economic systems (Martens *et al.*, 2009; McEvoy *et al.,* 2010). Near scientific consensus exists on the scientific explanation of climate change and the activities contributing to it (Martens *et al.*, 2009). Still, controversy remains on how to respond and who should address climate change, hampering a sufficient global response. This is in part because climate change is a "persistent" problem (Jänicke and Jörgens, 2007) in that it shapes and interacts with various aspects of modern economic, environmental, political and social processes at local, national and international levels over extended time periods. Climate change is influenced by a diverse set of stakeholders and contains multiple stressors, at multiple time and spatial scales (Adger, 2006; McEvoy *et al.*, 2010). Moreover, while the likely consequences of climate change are anticipated, uncertainty remains regarding the timelines of these consequences, their severity and their scale (Biesbroek *et al*., 2009; Klein *et al.*, 2007).

Meanwhile, while international and national climate governance strategies initially focussed on GHG reduction strategies, recent catastrophic events (e.g. the 2005 *Hurricane Katrina* and the 2012 *Superstorm Sandy* in the U.S., the 2013 *Typhoon Haiyan* in the Philippines, the 2014 monsoon and floods in Pakistan, to name a few) have shifted perspectives on climate change's timeline. It moved from something facing future generations, to something encountered by this generation. Although none of these events can be directly attributed to climate change, they have placed new urgency on the issue, and shifted (part of) the focus from preventing climate change to preparing for its consequences. As a result, climate change comprises two main focal areas: *mitigation strategies* to reduce GHG emissions and *adaptation strategies* to prepare for the consequence of climate change (Martens *et al.*, 2009). The IPCC suggests that cities and their metropolitan regions represent a platform to address climate change, both to mitigate GHGs and to reduce vulnerability via adaptation (IPCC, 2007b; Revi *et al.,* 2014; Seto *et al.,* 2014).

1.2.3 An Urban Era in a Time of Climate Change

Urbanisation and climate change are two pertinent global phenomena and they are inherently interlinked (Hoornweg *et al.*, 2011; UN-Habitat, 2011) in what Jordan and Huitema (2014, page 716) refer to as the relationship between, "complex 'mega trends' and their associated 'wicked' policy problems". Cities are responsible for 40-70% of GHG emissions[4] resulting from activities including: urban energy consumption in buildings and transport, waste and water services and industrial processes (Bulkeley, 2010; IEA, 2008; UN-Habitat, 2011). Equally, cities are vulnerable to the consequences of climate change, including: flooding from storm surges, UHI and infrastructure stresses (Revi *et al.,* 2014). Cities, however, are not only places of emissions and climate vulnerabilities; they are increasingly places of climate action (Dodman, 2009; Satterthwaite, 2008). Bulkeley and Castán-Broto (2012, p. 364) argue that, "cities can act more quickly on this issue than national governments." To address climate change on the ground local authorities incorporate energy efficiency standards in public buildings; developers add onsite renewable energy to rooftops; community groups plant gardens and trees; citizens increasingly bicycle or recycle. None of these actions or actors alone can tackle climate change, but together they can make significant inroads. While various stakeholder groups are involved in urban climate governance, this dissertation examines the role of local authorities – recognised as an important stakeholder to govern both mitigation and adaptation (Bulkeley and Castán-Broto, 2012; Hodson and Marvin, 2009; Mees *et al.,* 2012; UN-Habitat, 2011).

Over the past 20 years local authorities have engaged in numerous initiatives to mitigate GHG emissions via policies, technical/ infrastructure investments and communication (Hoornweg *et al.,* 2011; Kern and Alber, 2008). They have done so individually in particular cities, and collectively via city networks which focus on sharing knowledge and lobbying on behalf of cities at national and international fora (Bouteligier, 2012; Cities Alliance *et al.*, 2007; Gustavsson *et al.*, 2009; Hoppe and Coenen, 2011). Recently, local authorities have also engaged in strategies to address climate change adaptation (Hodson and Marvin, 2009; Mees *et al.,* 2012). Notably, while climate change is global, the capacity to act, as well as the vulnerabilities of social systems and ecosystems vary considerably, influenced by local socioeconomic and geographical realities (IPCC, 2013; Laukkonen *et al.*, 2009; Mees *et al.,* 2012; Nilsson and Gerger-Swartling, 2009; Storbjörk, 2007; UN-Habitat, 2011). Cities thus offer a suitable scale to address climate change: they are small enough to implement effective climate strategies (e.g. renewable energy investments, cycle lanes, green

4 Debate remains on how this is calculated, and whether cities (especially those investing in public infrastructure/ urban planning) can be more efficient than suburban/ rural areas at similar affluence levels (Satterthwaite, 2008; Dodman, 2009).

roofs); and together they are large enough to make a noticeable contribution (UN-Habitat, 2011; Storbjörk, 2007; Laukkonen *et al.,* 2009; Nilsson and Gerger-Swartling, 2009). Moreover synergies can be sought between mitigation and adaptation in cities. Scholars call for integrated climate strategies taking urban sustainable development goals and vulnerability considerations into account (Goklany, 2007; IPCC, 2007b; Klein *et al.,* 2007; Martens *et al.,* 2009). For example, via urban planning and densification, cities can facilitate public transport or cycling, which is beneficial for mitigation, whilst maintaining green and blue spaces, which is beneficial for mitigation and adaptation (EEA, 2009; Laukkonen *et al.,* 2009). Improved insulation of homes and offices can reduce energy consumption, while improving building comfort and reducing vulnerability to temperature extremes (AMICA, 2007). Still in many cities climate mitigation and adaptation planning continue to be viewed and addressed as separate issues, and thus continued attention is needed in order to create coherent and integrated urban climate strategies that link mitigation and adaptation (AMICA, 2007; Fünfgeld, 2010).

In its latest assessment report, the IPCC (2013) encouraged greater attention to sub-national action, recognising cities and urban areas as one of the most effective policy levels to address climate change. Bulkeley (2010) points to evidence that the private sector also perceives cities as places to act on climate change, for example partnering on the delivery of smart technology or supporting concepts such as smart urbanism. Philanthropy organisations (e.g. *100 Resilient Cities* supported by the *Rockefeller Foundation, Clinton Foundation's* climate efforts) and popular media follow this trend. Many media sources have launched city-specific sites reporting on how cities address climate change and other challenges, such as *The Atlantic's Citylab* or *Guardian Cities*[5]. Cities then are a recognised space of climate action.

5 An informal blog was set up in relation to this dissertation, called *The Urban Observer* (http://exploring-and-observing-cities.org) on how urban infrastructure, planning and policy influence individual choices. This blog is linked to the *Guardian Cities* blogger page. (See: http://www.theguardian.com/cities/interactive/2014/jan/27/best-city-blogs-interactive).

1.3 Urban Climate Action in a Time of Global and National Inaction

In 2009, the global community placed high expectations on nation states and world leaders to reach a new climate agreement at the *UN Climate Change Conference* in Copenhagen, Denmark during its 15th session of the *Conference of the Parties* (COP15). A binding agreement to replace the *Kyoto Protocol*[6] was not reached, and COP15 was largely considered a failure (Jordan and Huitema, 2014). COP15 however was not only about the commitments of national government authorities. Local climate actions were profiled in several high-level events, including the *Local Government Climate Roadmap* and the *Copenhagen Climate Summit for Mayors,* which called for greater attention and support for local climate action (ICLEI, 2010). Within the COP process, national authorities appear to have resigned themselves to a near permanent state of gridlock, unable to agree on ambitious targets, financial commitments or to disclosure procedures regarding GHG emissions data. Until 2014, they have been unable to reach a climate agreement. Meanwhile, local and regional authorities openly share ideas and discuss common challenges, albeit sometimes in friendly competitions to "out green" each other, branding their city's climate-friendliness by sharing examples of innovative projects, emission reduction targets, or citing city rankings[7]. Local authorities and other urban stakeholders offer concrete examples of how to address climate change and urge COP delegates to include cities within climate negotiations. This spirit of collaboration has received attention from both academic and political audiences.

The *United Nations Framework Convention on Climate Change* (UNFCCC) and its partners encourage a stronger focus on subnational/ local climate actions. For example, over the last COPs since Copenhagen (e.g. 2010's COP16 in Cancun; 2011's COP17 in Durban; 2012's COP18 in Doha) side events focussed on urban climate actions: on mitigation, adaptation or efforts to address both[8]. At COP19 in Warsaw, Poland in 2013, a workshop was organised for COP delegates on urbanisation and the role of local authorities to facilitate climate action within the *Ad Hoc Working Group on the Durban Platform for Enhanced Action* (IISD, 2013a). Additionally, local and regional climate actions were featured in 20 side events and other activities over COP19's two-week meeting. And for the first time at a COP, an

6 The Kyoto Protocol was adopted in 1997, entering into force in 2005. It commits Parties to binding GHG emission reduction targets, placing heavier burden on developed nations under the principle of *"common but differentiated responsibilities".* Its first commitment period ran from 2008-2012, and was extended from 2013- 2020 at COP18 (Doha, Qatar).

7 This includes: *European Green Capital* or the *Siemens/ Economist Intelligence Unit's Green City Index*.

8 See: http://www.iclei.org/climate-roadmap/advocacy/unfccc/friends-of-cities.html.

entire day was dedicated to subnational and urban climate action – *Cities Day* (UNFCCC, 2013). Cities Day included a high-level *Cities and Subnational Dialogue* hosted by the COP Presidency with keynote addresses from UN Secretary General Ban Ki-moon, UNFCCC Executive Secretary Christiana Figueres and Mayor of Warsaw Hanna Gronkiewicz, followed by presentations by UN representatives, mayors and city planners on local mitigation and adaptation actions in specific cities (see IISD, 2013b). In June 2014 at the UNFCCC-hosted *Bonn Climate Change Conference*, several events highlighted urban actions and the role of subnational authorities in mitigation and adaptation (IISD, 2014a; UNFCCC, 2014a; UNFCCC, 2014b).

In September 2014, UN Secretary-General Ban Ki-moon organised a *Climate Summit* prior to the UN General Assembly, in which cities were profiled as one of eight[9] climate action areas (IISD, 2014c). This Summit, occurring outside the UNFCCC process, brought 100 Heads of State together, government ministers, NGOs and business leaders, to build a common vision and generate support for the 2015 *UN Climate Change Conference* (COP21) in Paris, France. It is anticipated that COP21 will have to do what COP15 could not: to reach a binding and ambitious global agreement on climate change. If it is to do so, cities will need to be included in the debate. According to French Minister for Development Pascal Canfin, "Without cities and local authorities on board, no agreement will be possible in Paris" (ICLEI, 2013).

Cities and human settlements were also prioritised at the 2012 *Conference on Sustainable Development* (UNCSD, or Rio+20) in Rio de Janeiro, Brazil and in the outcome document, *The Future We Want* (paragraphs: 134- 137), as a physical place and political space to address sustainable development (UNCSD, 2012). Following Rio+20, a process ensued to draft Sustainable Development Goals (SDGs) to replace the Millennium Development Goals (MDGs) as part of the post-2015 development agenda. While the SDGs will be formerly adopted in mid-2015, until now Proposed Goal 11 aims to: "make cities and human settlements inclusive, safe, resilient and sustainable" (IISD, 2014b). Several other SDG goals[10] feature urban-relevant themes.

Regional and national fora and networks also stress cities as a solution space concerning climate change. In 2005, former Seattle Mayor Greg Nickels launched the *US Mayors Climate Protection Agreement* making a political statement that "cities will act" even if the U.S. national government is slower to do so. As of 2015, 1060 US cities have signed the Agreement, pledging to reduce GHG emissions in signatory

9 The 8 action areas: agriculture, cities, energy, finance, forests, industry, resilience and transport.

10 SDG goals that address urban issues include: water and sanitation (nr. 6), resilient infrastructure (nr. 9), and climate change (nr. 13).

cities below 1990 levels, in line with the Kyoto Protocol. In 2008, the European Commission launched the *Covenant of Mayors* as part of the *EU Climate and Energy Package*. The Covenant recognises local authorities' role to address climate change, in particular on sustainable energy policies. As of 2015, the Covenant has over 6,200 signatories pledging to meet and exceed the EU 20% CO_2 reduction target by 2020. Megacities (and partner "innovator" cities) also collaborate to reduce emissions in the C40 network – these cities alone represent 25% of global GDP (C40, 2015). Similar initiatives are underway in other world regions (e.g. the *Asian Cities Climate Change Resilience Network*, UN-Habitat's *Cities and Climate Change Initiative*).

In summary, cities are increasingly recognised as a climate solution space by UN bodies and UN processes, within (trans)national city networks focussed on climate governance (e.g. ICLEI, C40, Cities Alliance), and urban research networks (e.g. *Urban Climate Change Research Network*). Table 1-1 provides a brief summary of relevant decisions and events influencing city climate change policies.

1.4 Urban Climate Governance: a Framework

The governance of climate change takes place at different temporal and spatial scales, and in different sectors (Biesbroek *et al.*, 2009; Jordan and Huitema, 2014; Lidskog and Elander, 2010). This dissertation is placed within the broader governance of climate change literature and focuses on *urban climate governance*. More specifically, it examines the roles, means and methods of local authorities (and their interactions with other key stakeholders) in developing, adopting and implementing *urban climate strategies*[11] on both mitigation and adaptation (Bulkeley, 2010; UN-Habitat, 2011). While much research concentrates on mitigation and adaptation as separate strategies to be pursued distinctively with distinct trade-offs (Tol, 2005), this dissertation concentrates on how – in urban environments – these two climate strategies can be addressed simultaneously (Fünfgeld, 2010; Goklany, 2007; Martens *et al.*, 2009; Wilbanks and Sathaye, 2007).

Local authorities are (at least traditionally) responsible for coordinating and implementing urban planning and design strategies within their jurisdictions (e.g. transport planning, green spaces, building and construction policies); all which are relevant for climate change mitigation and adaptation (McCormick *et al.*, 2013; Lenhart *et al.*, 2014; Wilson and Piper, 2010). Research has also found that public

11 In this dissertation urban climate strategies, urban climate policy and local climate strategies are used, largely interchangeably.

Table 1-1 Selection of Conferences and Decisions Influencing Urban Climate Governance and Local Climate Policy

Year	Forum/ Event	Location	Relevant developments, official decisions and events concerning urban climate governance and/or local sustainable development
1972	UN Conference on Environment and Development (Earth Summit)	Stockholm, Sweden	UN Environment Programme (UNEP) established. Outcome Document: Report of the UNCED.
1975	UN-Habitat established	New York, USA	UN General Assembly (UNGA) established UN-Habitat and the Human Settlements Foundation under UNEP umbrella – the first UN body dedicated to urbanisation (with a limited initial role).
1976	Habitat I Conference	Vancouver, Canada	Outcomes: The Vancouver Declaration and the Vancouver Action Plans.
1987	World Commission on Environment and Development	Oslo, Norway	Outcome document: *Our Common Future* (or *The Brundtland Report*) led to formal definition of sustainable development. This report featured a focus on the worldwide growth of cities.
1988	Intergovernmental Panel on Climate Change (IPCC)		Established by the World Meteorological Organization (WMO) and UNEP, IPCC is tasked with preparing scientific assessments on climate change impacts and realistic response strategies.
1990	ICLEI Local governments for Sustainability established	New York, USA	ICLEI emerged as a partnership of 35 North American local authorities to phase-out ozone depleting substances. In 1990, 200 local authorities from 43 countries participated in the World Congress at UN Headquarters, adopting a charter and interim executive committee.
1992	UN Conference of Sustainable Development (UNCSD)	Rio de Janeiro, Brazil	Outcome document: *Rio Declaration on Environment and Development* and the launch of *Agenda 21* – a global action plan on sustainable development. Agenda 21 also had a local focus, *Local Agenda 21* (LA21) to facilitate local actions on sustainable development. UN Framework Convention on Climate Change (UNFCCC) and Convention on Biological Diversity (CBD) opened for signature.
1995	UNFCCC COP1	Berlin, Germany	First UN Climate Change Conference, the Conference of the Parties (or COP1).

Table 1-1 Continued

Year	Forum/ Event	Location	Relevant developments, official decisions and events concerning urban climate governance and/or local sustainable development
1996	HABITAT II Conference	Istanbul, Turkey	Conference addressed two themes: "Adequate shelter for all" and "Sustainable human settlements development in an urbanising world".
2002	World Summit on Sustainable Development (WSSD)	Johannesburg, South Africa	Outcome document: *Report of the World Summit on Sustainable Development* (emphasised local authorities' role to support sustainable development).
2002	UN-Habitat established by UN General Assembly	New York, USA	UN-Habitat (or UN Human Settlements Programme) was elevated to a fully-fledged UN programme (via UNGA Resolution A/56/206).
2002	UN-Habitat's World Urban Forum I (WUF)	Nairobi, Kenya	Held every two years, WUFs discuss key urban priorities, including climate and resilience. Subsequent WUFs occurred every two years in different global cities with different themes.
2005	C40 established	London, UK	Former London Mayor Ken Livingstone convened 18 megacities (now 75 cities, including e.g. megacities and innovator cities) to discuss urban GHG reduction and procurement strategies to accelerate climate-friendly technologies. In 2006, C40 partnered with CCI.
2005	U.S. Mayors Climate Protection Agreement	Seattle, USA	Former Seattle Mayor Greg made a political statement that if the U.S. national government will not act on climate change, local authorities will. As of 2015, 1060 U.S. cities have signed.
2005	World Mayors Council on Climate Change (WMCCC)	Montreal, Canada	Former Kyoto Mayor Yorikane Masumoto founded WMCCC soon after the Kyoto Protocol entered into force, in parallel to UNFCCC COP11 in Montreal.
2008	Covenant of Mayors established	Brussels, Belgium	Part of EU Climate and Energy Package, the Covenant supports developing, implementing and monitoring *Sustainable Energy Action Plans* (SEPAs).
2008	UNFCCC COP14	Bali, Indonesia	Included the Local authorities Climate Roadmap.
2009	UNFCCC COP15	Copenhagen, Denmark	Local Government Climate Lounge and related urban-focussed side events in conjunction to COP15.
2010	Resilience Cities Conference series established	Bonn, Germany	ICLEI, WMCCC and the City of Bonn launch an annual forum on urban resilience and adaptation to climate change.

2010	Convention on Biological Diversity (CBD) COP10	Nogoya, Japan	Adopted *Plan of Action on Sub-National Governments, Cities and Other Local Authorities on Biodiversity 2011-2020.*
2010	UNFCCC COP16	Cancun, Mexico	Prior to COP16: World Mayors Summit on Climate (WMSC) held in Mexico City Global Cities Covenant on Climate Change – or the Mexico City Pac.
2010	carbonn Climate Registry (cCR) established	Mexico City, Mexico	Global mechanism developed for and by local authorities to enable public and regular reporting on local climate actions, adopted at WMSC.
2011	UNFCCC COP17	Durban, South Africa	Durban Adaptation Charter, leading to a focus on actions in cities.
2012	UNCSD/ Rio +20	Rio de Janeiro, Brazil	Outcome Document: *The Future We Want* See paragraphs on human settlements: 134- 137.
2012	UNFCCC COP18	Doha, Qatar	Numerous side events focussed on urban actions of local authorities and sector-relevant strategies (e.g. urban planning, energy).
2013	UNFCCC COP19	Warsaw, Poland	ADP Workshop on urbanisation and local authorities; 20 side events on local climate action and dedicated "Cities Day" and High-Level session on Cities and Subnational Dialogue.
	100 Resilient Cities		Launched by Rockefeller Foundation to help cities become resilient to complex challenges.
2014	IPCC Assessment Report 5 released		Emphasis on urban contributions to climate change and actions in cities to address mitigation and adaptation.
2014	CBD COP12	Pyeongchang, Republic of Korea	Included: Biodiversity Summit for Cities and Subnational Governments.
2014	Bonn Climate Conference	Bonn, Germany	Emphasis on and events held in reference to urban mitigation and adaptation actions.
2014	Sustainable Development Goals adopted (in interim)	New York, USA	17 proposed SDGs adopted as part of the post-2015 development agenda. Proposed Goal 11 addresses cities and human settlements.
2014	UN Secretary General's Climate Summit	New York, USA	Cities and human settlements profiled as one of eight climate actions areas. Launch of the *Compact of Mayors*.
2014	UNFCCC COP20	Lima, Peru	Launch of the *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories,* and activities including: Local Climate Government Roadmap and Lima Dialogues.

authorities lead the vast majority of urban environmental planning experiments, especially during initial phases (Bulkeley and Castán-Broto, 2012; Mees *et al.* 2012). To analyse urban climate governance, and specifically how local public authorities design and implement climate change mitigation and adaptation strategies, a conceptual framework is developed and applied, consisting of three basic concepts: multilevel governance, governance capacities of local authorities and governance modes of local authorities (see Figure 1-4). These three interdependent components are described briefly below.

1.4.1 Multilevel Governance

Building on the discussion in Section 1.3 on urban climate governance in a global context, scholars recognise that the actions that city authorities take to address climate change locally – within their jurisdictions – must be placed in a larger system of *multilevel governance*, including the influences and interdependencies of both vertical and horizontal levels of governance (Corfee-Morlot *et al.*, 2009; Gupta *et al.*, 2007; Hooghe and Marks, 2003). Bulkeley (2010, p. 233) states: "it is no longer adequate to consider the urban governance of climate change solely from the perspective of municipal authorities but that it is necessary to consider how, why and with what implications other actors are seeking to govern the climate through the city." Bulkeley (2010, p. 240) goes on to describe multilevel governance as "the stage upon which the drama of urban responses to climate change are played out."

Vertical governance refers to how local authorities interact with higher governing bodies at regional, national, European[12] and international scales. This is particularly important in governing climate change, since many decisions taken at higher governing levels influence a local authority's ability and resources to adopt or implement urban climate strategies (Bulkeley, 2010; Corfee-Morlot *et al.*, 2009). Higher levels of government may support local authorities, for example via financial subsidies, legal support or guidance (e.g. the European Commission's Covenant of Mayors supports subnational authorities on *Sustainable Energy Action Plans*) (Bulkeley, 2010; Fitzgerald and Lenhart, 2015). Or they may constrain local authorities' ability to address climate change, for example by reducing a local authority's regulatory powers to govern climate change in relevant sectors (e.g. reducing a local authority's autonomy to enact stricter building codes than national standards) (den Exter *et al.,* 2014). Accordingly, national government policy can determine the success or failure of a particular (city) climate strategy (Jänicke, 2012; Keskitalo, 2008). While vertical governance often refers to how higher levels of decision-making influence (enable and constrain) local action, it also includes the role and actions of local or

12 The dissertation focused on European cities.

regional authorities to influence and shape national or international governing bodies to adapt their strategies on climate change or other policy foci (Corfee-Morlot *et al.,* 2011).

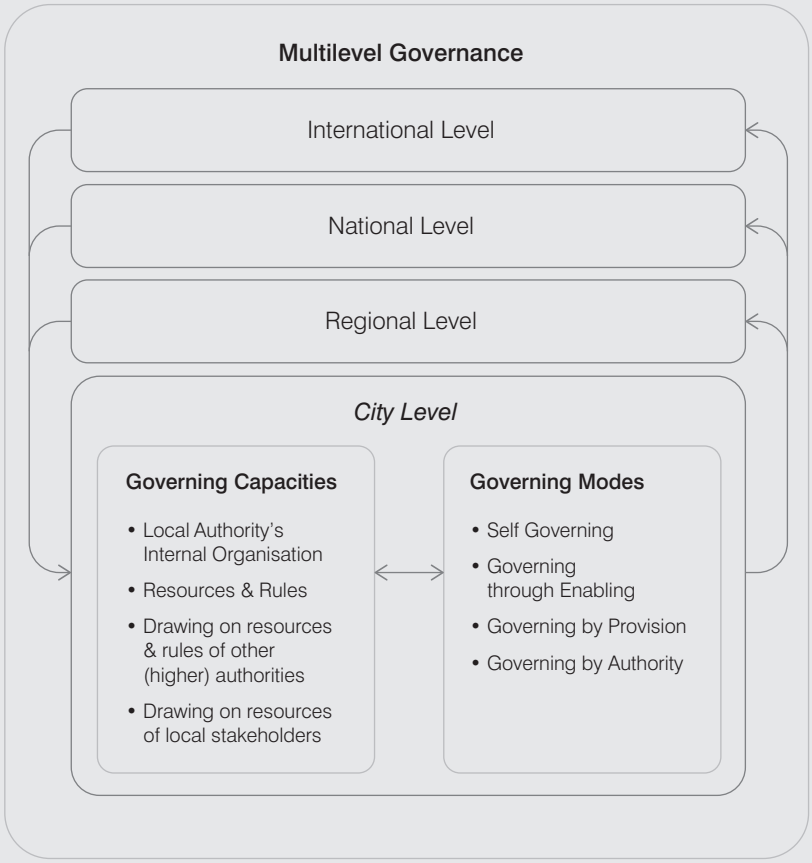

Figure 1-4 Governing Capacities and Governing Modes Influencing Urban Climate Governance[13]

13 In this image, vertical governing levels are explicitly depicted. However horizontal stakeholders, such as city networks and interactions between local authorities, are not explicitly depicted. These horizontal interactions are however implicitly mentioned in the reference to drawing on the rules and resources of higher (i.e. vertical) as well as other local (horizontal) authorities outside the city, and by drawing on local (horizontal) stakeholders inside the city.

Horizontal governance within multilevel governance refers to how local authorities collaborate horizontally with other local authorities (in other cities), sometimes across borders, for learning and lobbying (e.g. representation at national/ international fora such as UNFCCC meetings to urge for financial and legal resources dedicated to local climate action) (Bouteligier, 2012; Bulkeley, 2010; Burch, 2010). It includes interactions between local authorities with stakeholders in a particular city, with other local authorities in neighbouring cities in a region or province, as well as interactions in (trans)national city networks. Such networks can facilitate learning between cities, as well as perpetuate a city's branding strategy wherein a city or local authority attempts to market an innovative climate strategy, or present itself as a leader in urban climate governance; this can sometimes bring external resources to a city (Bulkeley, 2010).

1.4.2 Governing Capacities

While many different stakeholders are engaged in the governance of climate change in cities, local authorities are recognised as an instrumental player (Bulkeley and Kern, 2006; Satterthwaite, 2014). Understanding their role, this dissertation places specific attention on analysing and understanding the capacities that local authorities require, in order to govern climate change. What capacities do local authorities need, and how are these capacities enacted?

Governing capacity is commonly discussed in the urban climate governance literature (see for example: Bulkeley, 2010; Burch and Robinson, 2007; Glaas *et al.*, 2010; Juhola *et al.*, 2012; Jonsson *et al.*, 2012; Westerhoff *et al.*, 2011), with many references specifically to adaptive capacity. The IPCC (2007a, page 894) defines adaptive capacity as "the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments in both behaviour and in resources and technology". In this, there are two dimensions of capacity: generic capacity (e.g. general response capacities) and specific capacities (e.g. response to a particular event, technical expertise) (IPCC, 2007a; Klein *et al.*, 2007). Notably, adaptive capacity does not only refer to the capacity needed to adapt to climate change; it is a component of a larger set of capacities required to address both mitigation and adaptation – a system's response capacity (Martins *et al.,* 2009; Tompkins and Adger, 2005; Burch and Robinson, 2007). While mitigation and adaptation do differ, in terms of time and spatial scales and specific strategies pursued, the factors determining the capacity to mitigate are broadly similar to those capacities required to adapt (Burch and Robinson, 2007; Goklany, 2007).

Bulkeley (2010) refers to several factors that influence local authorities' governing capacities, including their *internal organisational dynamics* and *the resources and rules* available. Capacity alone is not sufficient to enable urban climate governance

(Jänicke, 2007; Westerhoff *et al.*, 2011). Equally, it is important to consider components that support local authorities to realise climate strategies, including by utilising the resources and knowledge of external stakeholders to enhance existing capacities, thereby leading to greater climate action (Westerhoff *et al.*, 2011). This dissertation refers to those components as: *drawing on the rules and resources of other authorities* (i.e. at vertical or horizontal levels) and *drawing on the resources of local stakeholders* (i.e. the resources of citizens or stakeholders in a city).

A local authority's *internal dynamics and coordination,* which influence capacity, include how and where climate rules and resources are located (i.e. in one or several departments) and whether a clear division of responsibility exists within departments and sectors (Bulkeley, 2010; den Exter *et al.*, 2014; Glaas *et al.*, 2010). Environmental departments often coordinate climate strategies; however since climate change is a crosscutting issue, it requires the engagement of multiple departments (e.g. transport, finance) (Bulkeley, 2010). Some local authorities install a climate manager to coordinate between departments; others enact a steering committee with well-divided tasks per respective department or stakeholder (den Exter *et al.*, 2014). Equally, local leadership (e.g. leaders who see barriers as opportunities, who allocate sufficient resources) and the internal dynamics of a local authority's organisational structure (e.g. open communication between senior and junior staff, the level of trust) may influence local capacity (Burch, 2010; Folke *et al.*, 2005; Shaw and Theobald, 2011). *Resources and rules* enable the implementation of urban climate strategies. These include: access to sufficient financial and human resources, as well as knowledge, information and expertise on how to address a particular issue (Burch, 2010; Bulkeley, 2010; Fünfgeld, 2010). Methods to enhance capacities include trainings, hiring new personnel, or drawing upon the resources of other city departments (Hinkel *et al.*, 2009). Equally, a local authority's ability to enact and regulate urban climate strategies is influenced by its relative autonomy with respect to higher governing levels (Bulkeley, 2010). In Sweden, a decentralised governing structure grants local authorities the rights and responsibilities with respect to planning and risk management; this provides local authorities the rulemaking power to take local actions to address climate change (Glaas *et al.*, 2010).

Drawing on the rules and resources of higher authorities refers to how or to what extent local authorities make use of the resources available to them from other vertical or horizontal governance bodies, as well as to what extent these resources are readily available (Bulkeley, 2010; Gustavsson *et al.*, 2009). National and EU authorities and city networks may offer financial subsidies, test pilot projects, or provide technical guidance to local authorities, to facilitate learning and sharing, thereby extending local capacity (Baker and Eckerberg, 2007; Bouteligier, 2012).

Research also suggests that capacity is enhanced when *drawing upon and engaging the resources of local stakeholders and citizens* (Jonsson *et al.*, 2012; Westerhoff *et al.*, 2011). Collaboration between local stakeholders and city authorities to jointly plan climate strategies can improve the diffusion of a city's climate strategies, including via increasing stakeholder ownership of such strategies, making use of additional capacities present in a city (e.g. technical capacities) or by promoting a particular citizen behaviour (Klein *et al.*, 2007; Ohnishi *et al.*, 2012). It may also lead to co-created urban climate strategies, while ensuring that local expertise are not overlooked but reinforce a local authority's existing capacities (McEvoy *et al.*, 2010).

1.4.3 Governing Modes

As a result of the principles and ideas of *New Public Management* formulated in the 1980s, formerly publically managed services (e.g. energy, public transport, water) were privatised, or transitioned to a hybrid form of public-private management, in quite a number of cities (Wollman, 2004). Consequently, in those cases local authorities now have fewer regulatory powers to enact climate strategies and must find other methods and modes to facilitate urban climate governance within their jurisdictions (Bulkeley and Castán-Broto, 2013). Environmental governance, as well as urban climate governance, then plays out in "a complex web of state and non-state actors operating and interacting at different policy levels" (Jänicke and Jörgens, 2007, page 173). According to Hudson and Marvin (2009) this has led to the creation of novel governance arrangements, between national and local authorities, and in partnership with private sector and civil society organisations.

Within cities, local authorities have introduced four distinct *modes of urban climate governance*: self-governing, governing through enabling, governing by provision, and governing by authority (Bulkeley and Kern, 2006; Kern and Alber, 2008). These governing modes represent different methods in which local authorities address climate change, working internally in their own organisation, as well as collaborating externally with stakeholders, citizens and other public bodies (see Table 1-2). Most local authorities demonstrate a combination of different modes in addressing climate change.

1.5 Research Questions

This dissertation examines the strategies and efforts of forerunning local government authorities to develop and implement urban climate governance. To do so, it has the following research question: *How do forerunning local authorities govern climate change in a city, and how can their effects be improved?*

Table 1-2 Modes of Governance

Mode	Explanation	Example(s)
Self-governing	The municipality as governor of their own activities, including consumption: how local authorities manage their own consumption.	• Energy efficiency measures adopted in public buildings; • Renewable energy investments (e.g. solar/ urban wind) on public buildings; • Green public procurement (e.g. renewable energy, organic food catering contracts).
Governing through enabling	The municipality as facilitator: how local authorities coordinate or facilitate partnerships between private stakeholders, or encourage citizens/ stakeholder engagement.	• Awareness campaigns or competitions; • New energy strategies based on cooperation and collaboration; • Local financial subsides for civil society or small businesses.
Governing by provision	The municipality as provider: how local authorities can provide infrastructure or other services to enable climate-friendly behaviour.	• Public transport initiatives: such as bicycle lanes, electric car charging stations; • Land allocation (e.g. urban agriculture).
Governing by authority	The municipality as regulator: how local authorities exploit their legal powers to manage and govern urban climate strategies.	• Congestion charges; • Green roof requirements on new buildings.

The main research question is divided into three sub-questions which examine specific components of urban climate governance, namely: (1) the capacities of local authorities, (2) the governing modes applied by local authorities to address climate change, and (3) further improvement and diffusion of urban climate governance.

- ❖ How do forerunning local authorities draw upon capacities, and which governing capacities do they apply, to address climate change in a city?
- ❖ What governing modes do forerunning local authorities apply to address climate change?
- ❖ How can best practices in urban climate governance be further improved within a particular city and diffused to other cities?

1.6 Research Methodology

1.6.1 Research Strategy and Design: Case Study Research

The research questions are of a qualitative nature. As such, to answer these questions, a multi-method research design, primary consisting of case study research, is used. The research consists of a review study and three case studies that were selected to explore best practices in urban climate governance of local authorities in Northwest Europe. The local authority serves as the main unit of analysis in the case studies (Gray, 2004). A case study research approach allows the researcher to study and describe a current or emerging phenomenon in a real-life context, using multiple data resources. Case studies can provide an in-depth understanding of a particular phenomenon by examining the perspectives of, and interactions between, different stakeholders (Yin, 2009; Baxter and Jack, 2008). Additionally, case studies require close collaboration between the researcher and the participants, allowing participants to share their stories and perspectives, thus enabling the researcher to gain a more in-depth understanding and interpret a particular case (Baxter and Jack, 2008).

This dissertation incorporates a multiple (as opposed to single) case study design, in order to examine different aspects of urban climate governance, including different sectoral strategies (e.g. energy, food, urban planning) and different interactions within local authorities across departments, and between local authorities and other key stakeholders. As such, this research incorporates a multiple, but not a comparative, case study approach; each empirical case study examines a particular aspect of urban climate governance in greater depth. The selected case studies represent so-called 'critical' case studies (Yin, 2009) as these cities and their local authorities are considered forerunners in urban climate governance on a particular aspect (e.g. sectoral strategies, stakeholder interactions). Together the different studies build a rich understanding of how forerunning local authorities govern climate change in cities, by examining different interactions of the local authority (see Figure 1-5). The review study and the case studies combined provide answers to the core research question and sub-research questions. The final analysis brings these case studies together to gain a full understanding of urban climate governance and the role of local authorities.

1.6.2 Case Study Selection

The review study and three case studies each represent an interaction between local authorities and a key stakeholder group (see Figure 1-5) and focus on specific climate-relevant sectors. While each study does not exclusively focus solely on one stakeholder interaction, each study concentrates on one of the stakeholder groups identified (see Figures 1-6 to 1-9). In selecting the cases, several criteria were applied:

innovativeness in urban climate governance in different sectors; cities and local authorities considered as best practice or "forerunning" cases in urban climate governance as proven by existing recognitions, notoriety and awards; cities focussed on international dissemination; interactions between local authorities and different stakeholders; a focus on mitigation and adaptation strategies, often linking to broader sustainable development strategies; and data and information accessibility. The review study conducts an overview of climate strategies in the 25 largest Dutch municipalities in a multilevel system. The selected case study cities are: Malmö, Sweden, and the Dutch cities of Rotterdam and Amsterdam. Table 1-3 details the characteristics of the case study cities, which are further elaborated below.

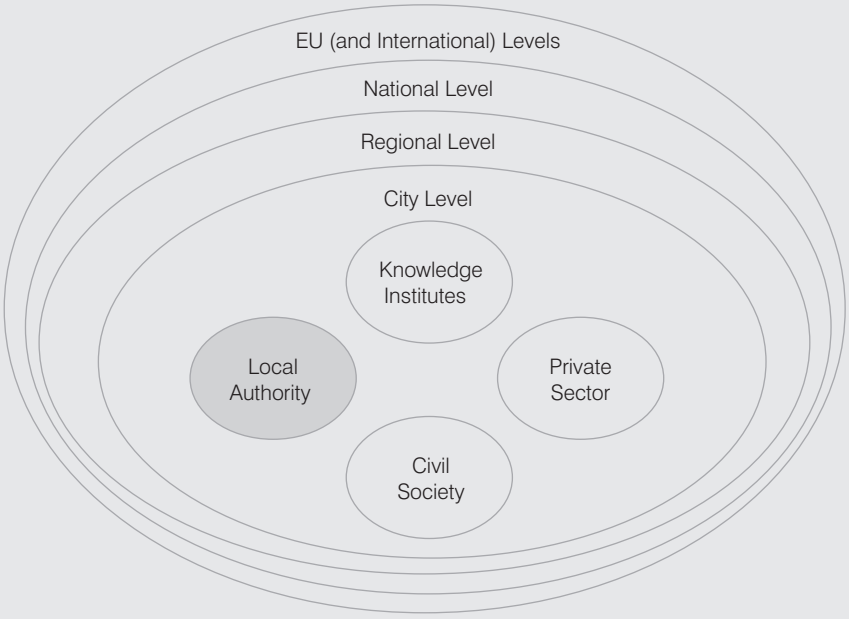

Figure 1-5 Modelling Case Studies in Urban Climate Governance

Table 1-3 Description of Case Studies

Study conducted	Stakeholder interaction examined	Mitigation and/ or adaptation, and sectors examined	Main documents and policies examined
Dutch cities (review study)	Interactions and influences of Dutch/ EU levels on local authorities	Mitigation and Adaptation • No specific sectors addressed	• NL Agency's Climate Monitor data bank on Dutch municipalities on support for local policy • City climate strategies
Malmö, SE (case study)	Focus on local authority's internal organisational structure, and how it engages across departments and key stakeholders	Mitigation and Adaptation • Energy (and buildings) • Transport • Urban Planning	• Master Plan • Environment Programme • Action Plan for Adaptation • Energy Strategy • Various sector-based strategies
Rotterdam, NL (case study)	Focus on how local authorities interact with (private sector) stakeholders and knowledge institutes	Primarily Mitigation in context to the case study • Energy • Urban Planning	• Rotterdam Climate Initiative • Programme on Sustainability and Climate Change • Mitigation Action Programme • REAP • Densification Strategy • Rotterdam Climate Proof: Adaptation Programme
Amsterdam, NL (case study)	Focus on how local authorities interact with civil society	Mitigation and Adaptation • Food systems • Urban Planning	• Food Vision • Sustainability Programme • Structural Vision • Rainproof Strategy

	City Network affiliations and recognitions on urban climate/ sustainability governance
	National support for local climate strategies: NL Agency's (an agency under the former Ministry of Economic Affairs, Agriculture and Innovation, involved with local/regional climate policy) local climate efforts The Dutch city network: *Klimaatverbond* *Selected city network affiliations*: Baltic Development Forum; Baltic Metropoles; Covenant of Mayors; Eurocities; ICLEI; Sustainable Cities and Towns Campaign; Union of Baltic Cities; and the (Swedish) *KlimatKommunera* *Selected recognitions*: first (of 800 projects) in EU Campaign for Take-off for renewable energy (2000); Design Prize winner (2005); Livable Communities Award winner (London, 2007); BEX Award for Best Master Plan (World Green Building Council, 2009); UN-Habitat's Scroll of Honour winner (2009); World Habitat Award (2010); Idébanken's prize for long-term sustainability (2011); WWF's Earth Hour Capital (2011); EC's RegioStars Award for integrated sustainable development (2012); European Green Capital finalist (2012/2013). *Selected city network affiliations*: Connecting Delta Cities (host); Covenant of Mayors; C40; Eurocities; ICLEI; the 100 Resilient Cities Network; the (Dutch) Knowledge for Climate Network, (Dutch) *Klimaatverbond*. Hosted the *Deltas in Time of Climate Change Conference* in 2010 and 2014. *Selected recognitions*: Sustainable Architecture award at Green Buildings 2020 conference (2011); Solar City 2012 at Dutch *Solar Days* event; Fourth on technical ranking of the European Green Capital (2014); World Capital for carbon capture and storage by Clinton Climate Initiative; one of the New Economy Smart Cities (2014). *Selected city network affiliations*: Covenant of Mayors; C40; Eurocities; ICLEI; and (Dutch) *Klimaatverbond*. *Selected recognitions*: European Green Capital finalist (2010/2011); City Climate Leadership Award (2014); notoriety for sustainable transportation (re: cycling and electric mobility) and *Amsterdam Smart City*.

The first study conducts a review of urban climate governance in the 25 largest local authorities[14] in the Netherlands (with a population over 100,000). This study provides general insights as to the anchoring of climate strategies in the organisation, policy and implementation within Dutch local authorities, and aids the selection of the two Dutch case study cities investigated in this dissertation: Amsterdam and Rotterdam[15]. This review study specifically examines the influences of vertical and horizontal governing bodies on local authorities' climate strategies, revealing that these influences can either hinder or support a local authority's ability to govern climate change. In addition, it studies how local authorities work with neighbouring municipalities to share strategies and support in addressing climate change in a metropolitan region (see Figure 1-6).

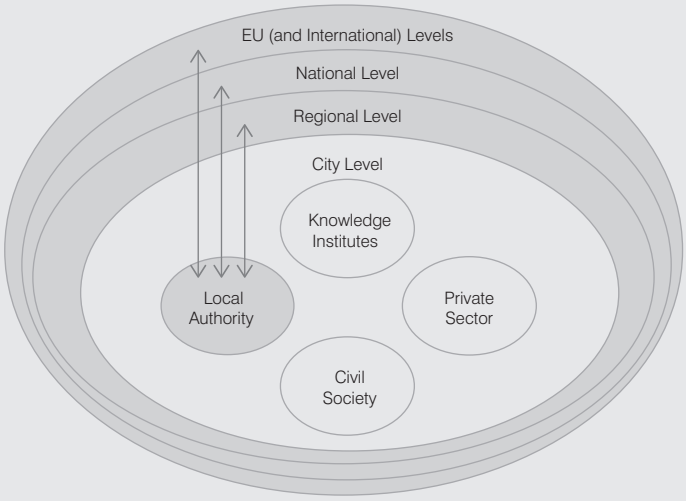

Figure 1-6 Review Study

14 With the assistance of an MSc student, data was obtained from national statistics, policies, rankings, websites and relevant documents, complemented by telephone interviews and questionnaires with a local authority representative from each of the 25 cities, as well as several in-depth interviews with experts from national government agencies and Dutch city networks.

15 Four reference cities (of 25) were considered to have a higher performance compared to the other cities. These were: Amsterdam, Den Haag, Rotterdam and Tilburg (den Exter *et al.*, 2014). Tilburg was ranked higher (by its peers) in this study. However Amsterdam and Rotterdam were selected due to their international positioning and notoriety, and efforts to disseminate their climate strategies.

The second (case) study conducts an in-depth analysis on the internal workings of a local authority in addressing climate change in Malmö, Sweden (population circa 279,000; see Figure 1-7). Malmö was selected for several reasons. Firstly, Malmö is widely seen as a forerunner in urban climate governance. This includes recognition by national, European and international awards, acknowledgements and placement in city rankings (see Table 1-3) as well as by academic and popular studies (Dowding-Smith, 2013; Fitzgerald and Lenhart, 2015; Norrman, 2010). Due to the collapse of its industrial sector in the 1980s/ 1990s and its consequent economic downturn, Malmö had to learn to work both internally and with stakeholders to transition through its crisis; thus being an interesting study to examine its internal organisational dynamics. It did so by focussing on sustainable development and environmental strategies, becoming an early leader in mitigation strategies and later on adaptation. Secondly, formerly I was formerly employed by Malmö's Local Authority, providing in-depth insights and easy information access on the inner workings of a local authority's organisation. Thirdly, previously an industrial hub, Malmö remains home to a large-scale (private-sector) natural gas production facility that notably influences its GHG emissions, requiring collaboration between the local authority and its main energy providers to reach the city's GHG mitigation targets. This case study specifically examines the local authority's internal interactions (within and across departments) to develop and deliver its climate strategies, taking an explicit look at the role of dialogue and learning, both within the local authority and how it interacts with stakeholders.

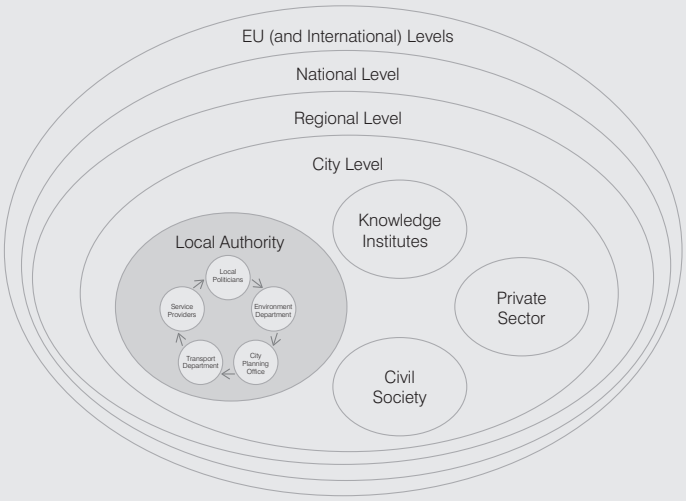

Figure 1-7 Malmö Case Study

The third (case) study conducts an in-depth analysis investigating the interactions between a local authority, together with private-sector stakeholders (e.g. housing/ energy companies) and knowledge institutes, for the design, delivery and implementation of the *Rotterdam Energy Approach to Planning* (REAP; see Figure 1-8).

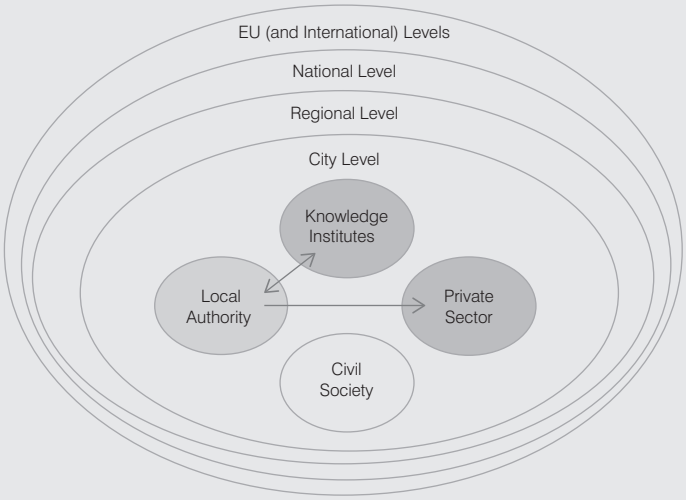

Figure 1-8 Rotterdam Case Study

REAP takes place in Rotterdam, the Netherlands (population 615,000). Rotterdam is selected for several reasons. Firstly, Rotterdam's local authority stresses collaboration with horizontal and vertical governing bodies and stakeholders (e.g. port authorities, the Dutch EPA, private-sector stakeholders) in the design and delivery of its innovative climate strategies, notably within its *Rotterdam Climate Initiative*, which addresses mitigation and adaptation. Secondly, Rotterdam emits between 16- 25% of Dutch GHG emissions, mostly from its port; in part because of this Rotterdam became an early adopter of mitigation and resource efficiency strategies which require working with a variety of stakeholders (RCI, 2010; Gupta *et al.*, 2007). Thirdly, Rotterdam is a low-lying coastal city on a river delta and has prioritised learning to adapt to climate change, thus becoming a recognised leader in climate change adaptation[16]. This case study examines interactions between Rotterdam's local authority and key stakeholders in the design and implementation of an innovative and emerging climate strategy, which specifically draws on the links between urban energy management and urban planning.

16 http://www.iclei-europe.org/members/member-in-the-spotlight/archive/rotterdam/

The fourth (case) study conducts an in-depth analysis on the interactions between a local authority and civil society organisations in Amsterdam, the Netherlands (population 780,000) focussing on urban food strategies (the Amsterdam Food Vision) and urban agriculture initiatives (see Figure 1-9).

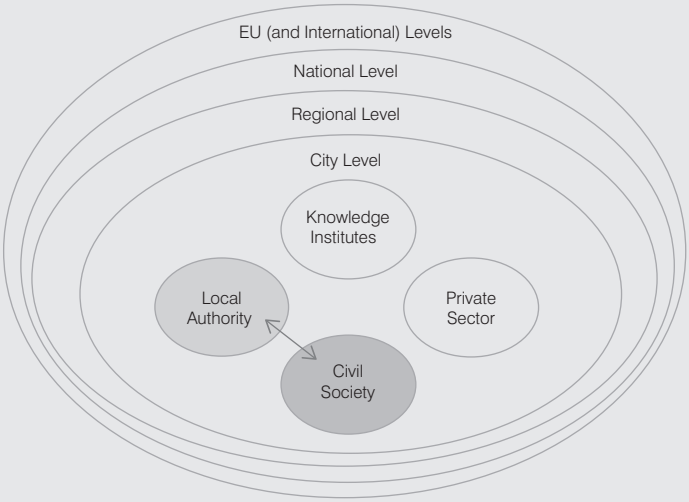

Figure 1-9 Amsterdam Case Study

While urban food strategies are not normally recognised as relevant for climate policy, this study takes an explicit look at their benefits for both local adaptation and mitigation efforts. Amsterdam was selected as a case study for several reasons. Firstly, like Rotterdam, Amsterdam is a low-lying river city and must adapt to climate change. Secondly, Amsterdam is renowned for its efforts in mitigation-relevant sectors, such as urban land management (e.g. mixed use city planning, cycle planning) and the adoption of innovative strategies to create a more energy efficient city (e.g. *Amsterdam Smart City*, focussing on smart technology solutions). Similar to Malmö and Rotterdam, vertical and horizontal collaboration are important (See Table 1-3). Finally, Amsterdam is a leading European city with respects to urban food strategies (Morgan, 2009) and demonstrates a growing interest in urban agriculture. This study prioritises collaboration between the local authority, local food NGOs and community organisations concerning the city's food strategy and urban agriculture efforts and how these are – and can be better – linked to local climate strategies.

It is not entirely accidental that the case studies come from the Netherlands and Sweden. Sweden and the Netherlands were early forerunners in *Local Agenda 21* strategies, already in the 1990s (Coenen, 1998; Eckerberg and Forsberg, 1998). Both formerly offered subsides for local climate action and sustainable development, including the Dutch *SLOK* (Stimulation Local Climate Initiatives) and the Swedish *KLIMP* (Climate Investment programme). Sweden was listed in second for the 2015 *Climate Change Performance Index* and for several years[17] prior (Burck *et al.,* 2014). In both Sweden and the Netherlands, national rankings of cities are available (e.g. *Dutch Friends of the Earth Klimaatkaart, Swedish Society for Nature's Climate Index)* which supported the selection of case study cities. Finally, many Dutch and Swedish cities engage in national (e.g. Swedish *Klimatkommunerna*, Dutch *Klimaatverbond*) and transnational city climate networks (e.g. ICLEI, C40, Eurocities) as well as regional umbrella programmes (e.g. *Klimaat op Orde* in Utrecht) that emphasis learning, dialogue and capacity building within and across cities.

1.6.3 Data Collection Methods and Research Validity

Three main data collection methods were applied in this study: document analysis, semi-structured interviews and participant observation. The general data gathering methods are described below, while further details on the specific case studies are described in the empirical chapters.

❖ Document Analysis

Throughout the research, a variety of document sources were consulted and analysed, including: official government documents, urban climate strategies and relevant city policies, unofficial reports of city meetings and discussions between local authorities and stakeholders, city and stakeholder websites, NGO publications and popular media reports. These document reviews offered information and insights on how local authorities develop and implement their climate change strategies and interact with (local) stakeholders and vertical and horizontal authorities. Doing so assisted the corroboration and augmentation of the other data sources used in the case studies.

❖ Semi-Structured Interviews

In qualitative research, interviews serve as a key data collection tool, enabling the interviewer to access a particular source of expertise, while taking the interviewee's perspective, attitude and interpretation of particular phenomenon into account. Using semi-structured interviews offers some flexibility, and may enable more in-depth insight of a particular phenomenon that is not widely documented. Topic lists with

17 Sweden ranked in the top three positions of this index in 2010- 2014, and first in 2008 and 2009. Technically ranking 5th in the 2015 CCPI, no country was listed in the top three slots.

several general and specific questions were prepared for each interview (for an example see Appendix 1). Additionally, each interview began with several tailored questions to understand the specific perspective and expertise of an interviewee.
In total, 67 interviews were conducted over four years (September 2010- December 2014). The interviews were primarily conducted face-to-face, however some interviews (e.g. those performed for the review study) were conducted by telephone. Most interviews generally lasted between one and two hours. Before each interview commenced, interviewees were informed that their responses would be included in the research project, although their personal anonymity would be protected. After each interview, a transcript was produced and follow-up ensued (usually by email) with the interviewee if/ when particular issues required verification. Most interviewees worked either directly at a local authority, or worked closely with local authorities as a stakeholder in urban climate governance. A full list of interviewees is included at the end of this dissertation (Appendix 2).

❖ **Participant Observation**

Two types of participant observations are included in this research: (1) attendance at policy/academic conferences and events, and (2) consistent (long-term) participation in several Malmö- and Amsterdam-based sustainability projects. Attending particular conferences and events complemented and enriched the general understanding of urban climate governance. These events sometimes offered insights beyond the case study cities, allowing the research to be placed in a broader European/ global context. Moreover, attending European and international fora, such as UN climate change negotiations, provided insight on the emerging role and relevance of cities and local authorities in the wider climate change governance debate. While most of these meetings were attended as a participant, during several instances I also served as a report writer for the International Institute of Sustainable Development Reporting Services Division (see iisd.ca). A full list of policy and academic conferences and events attended can be found in Appendix 3.

Concerning participant observation, I was formerly employed at Malmö's City Planning Office (February- June 2008) and its Environmental Department (January 2009- July 2010). During this time I became privy to the local authority's inner functioning, including how it interacts across departmental silos and engages with stakeholders on climate-relevant topics. For example, I participated in a series of meetings known as the *Building-Living-Dialogue* (Swedish: *Byggabodialogen*)[18] engaging representatives of several city departments, together with architects and

18 This dialogue was part of a national process to improve dialogue in designing new neighbourhoods. http://malmo.se/download/18.24a63bbe13e8ea7a3c6989c/1383643954411/The+Creative+Dialogue+Concerning+Flagghusen.pdf

developers for the design of a new climate-friendly neighbourhood in Malmö's Western Harbour; I attended city network meetings (e.g. *Eurocities Environment Forum*); and I participated in EU projects, such as *Urban Matrix*[19] with the purpose to exchange knowledge between EU cities on urban sustainability. For the Amsterdam case study, I participated in several urban agricultural initiatives over two years (September 2012- December 2014). During time spent in the gardens, numerous workshops were conducted (e.g. on permaculture, biodynamic farming, seed saving, composting) and informal conversations were held with fellow volunteers on topics including: their reasons for participation, predicted growth in local food production in and around Amsterdam, the connections between local food production and climate change, and specific farming techniques. Also, an internship at UN-Habitat (June-December 2008) working with the *Cities and Climate Change Initiative* granted insights into how urban climate governance is addressed in a global context.

❖ **Data analysis**

Data analysis consists of organising, sorting and making sense of the empirical data gathered. The coding of data (wherein data are labelled according to a set of categories to examine linkages, comparisons and contrasts) is inspired by theoretical concepts and interviews; this is generally preferred for case study research, which attempts to capture a narrative's flow (Bryman, 2004). The data analysis strategy aligns with the dissertation's theoretical propositions – a preferred option for case study designs (Yin, 2009). In this study, local authorities and their relationship(s) with different stakeholder groups are analysed, examining the role of governing capacities and governing modes to facilitate urban climate governance.

❖ **Validity**

The use of qualitative methods to gather data (such as the case study research strategy in this dissertation) come with specific challenges that a researcher must address (Bryman, 2004; Yin, 2009). Notably, validity must be ensured, in terms of: the quality of the data gathered; the data collection procedures pursued; and the analysis and interpretation of that data. This includes 'external validity' referring to the ability to generalise results, as well as the integrity of the conclusions reached; and 'internal validity' referring to the integrity of the relationship between the theoretical underpinnings and the empirical results. Concerning external validity, it is important to acknowledge a limitation of this dissertation, in that its final conclusions may have reflected different results if the case study cities, or the particular stakeholder interactions and sectors studied in each case study, differed. Still, some external

19 Information on the Urban Matrix project: http://ec.europa.eu/research/environment/pdf/project_summaries/fp6/land_and_urban_management/urban_matrix.pdf

validity can be achieved by connecting the empirical data to the theoretical underpinnings used in the case studies. Concerning internal validity, it is imperative that the concepts used in the research are consistent with the research findings (Bryman, 2004). Using triangulation, a method wherein three or more data gathering techniques and multiple data sources are used, can help ensure this (Bryman, 2004; Yin, 2009). Triangulation is used in this study's research design and execution, by combining several qualitative methods to gather data: document analysis, semi-structured interviews, and participant observations.

1.7 Dissertation Outline

This dissertation is presented in a publication-based format, with the next four empirical chapters written as stand-alone pieces for publication as scientific articles.

Chapter 2 examines how (Dutch) local authorities perform on urban climate governance by conducting a review of the 25 largest cities in the Netherlands. It pays specific attention to how climate strategies are locally anchored: how they are organised, embedded in policy, and practically implemented. A multilevel governance perspective is incorporated to examine how climate strategies are influenced vertically and horizontally.

Chapter 3 examines the *City of Malmö*, conducting an in-depth study of the inner workings of a local governmental authority. While local authorities are often viewed as singular entities, this research reveals that they are a sum of many parts, often with competing perspectives and interests on how to prioritise local policy challenges, such as climate change. Theoretically, it explores how local authorities can adopt the structure of a *learning organisation* in their working methods and organisational structure to be more responsive to emerging challenges, such as climate change.

Chapter 4 examines the *City of Rotterdam*, and focuses on the interactions between local authorities, knowledge institutions and energy stakeholders to facilitate improved urban resource management. It conducts an in-depth analysis of the Rotterdam Energy Approach to Planning (REAP). REAP is a city planning approach aimed at CO_2 neutrality, linking energy planning to urban planning to facilitate more efficient use and reuse of urban resource flows (e.g. heat and cold exchanged between urban functions). Theoretically, it incorporates an *urban symbiosis* lens while acknowledging the role of local authorities to facilitate strategies to improve the efficiency of urban resource management.

Chapter 5 examines the *City of Amsterdam*, and focuses on the interactions between local authorities and civil society to address urban climate strategy goals. Specifically it examines Amsterdam's urban food strategy and urban agricultural initiatives from an urban climate governance lens. While these are rarely interpreted as components of a city's climate strategies, they have benefits for both mitigation and adaptation goals (e.g. reducing food miles, increasing urban green space). Theoretically, it explores how top-down support and bottom-up engagement can be combined to support urban food strategies and urban climate governance.

Finally, **Chapter 6** provides a general reflection of the empirical cases, how these cases contribute to urban climate governance, specifically on the governing capacities and governing modes applied by local authorities within a multilevel governance system. It also draws conclusions for the broader dissertation study. It finishes by offering several areas for future research concerning urban climate governance.

2

Governing Climate Change in Dutch Cities: Anchoring Local Climate Strategies in Organisation, Policy and Practical Implementation[20]



20 A version of this paper is published as: Den Exter, R., Lenhart, J. and Kern, K. 2014. Governing climate change in Dutch cities: anchoring local climate strategies in organization, policy and practical implementation. *Local Environment* doi:10.1080/13549839.2014.892919.

Abstract

Although Dutch cities were among the forerunners in local climate policy, a systematic overview on climate mitigation and adaptation policy is still missing. This study aims to fill this gap by analysing 25 Dutch cities using indicators for the level of anchoring in policy, organisation and practical implementation as well as multilevel relations. Since Tilburg, Amsterdam, Den Haag and Rotterdam show a higher performance than other Dutch cities, these four cities are used as reference cities. The findings suggest that structural integration of climate mitigation and adaptation is limited in Dutch cities. The study points at three recent trends in local/ urban climate governance in the Netherlands: (i) *decentralisation* within municipal organisations, (ii) *externalisation* initiatives that place climate policy outside the municipal organisation and (iii) *regionalisation* with neighbouring municipalities and the provincial government.

2.1 Introduction

Climate change is a global problem that requires local action. Action in cities is crucial. Not only is a high portion of greenhouse gases (GHGs) emitted in cities, justifying local climate mitigation strategies, cities also have to adapt themselves to the effects of climate change (Bulkeley and Kern, 2006; IPCC, 2007a; Hoornweg *et al.,* 2011; OECD, 2010; UN-Habitat, 2011). In cities, with their high concentration of people, buildings and infrastructure, the impacts of climate change can be severe (Carter, 2011; Da Silva *et al.,* 2012; UN-Habitat, 2011). As the governance level closest to the people, municipal governments are in a good position to develop mitigation and adaptation policies that have a direct influence on their cities and citizens (Betsill and Bulkeley, 2007; Bulkeley, 2013; Castán-Broto and Bulkeley, 2013; Kern and Mol, 2013; Lindseth, 2004; McCormick *et al.,* 2013; UN-Habitat, 2011). Moreover, by integrating mitigation and adaptation, cities can look for system-wide synergies, while preventing negative relations between the two (AMICA, 2007; Hamin and Gurran, 2009; Klein and Huq *et al.,* 2007; Laukkonen *et al., 2009;* Nilsson and Gerger-Swartling, 2009).

Over the last 20 years, many regional and local initiatives to address climate change have emerged, especially concerning mitigation (Bulkeley, 2013; Bulkeley, 2010; Klostermann *et al.,* 2009). There appears however to be a gap between the rhetoric and reality of local climate action. Although local action is seen as the way forward and it is often assumed "cities are performing well", this is not often well researched. At least in the Netherlands, no systematic overview exists of climate policy in its cities. Most studies focus on a limited number of case studies and the need is expressed for further comparative research using a significant number of cases (Castán-Broto and Bulkeley, 2013; Kern and Alber, 2009). Moreover, most studies focus on mitigation or adaptation, but do not provide a comprehensive perspective (Bergsma *et al., 2012;* Gupta, 2007; Gupta *et al.,* 2007; Kern and Alber, 2009; Meyer *et al.,* 2012; Nilsson and Gerger-Swartling, 2009; van den Berg and Coenen, 2012). Dutch cities are an interesting focus since the Netherlands was traditionally referred to as a leader in local climate action (Gupta *et al.,* 2007). Additionally a vast part of the country lies at or below sea level, thus adapting to climate change becomes a pertinent reality (Bergsma *et al., 2012;* Klostermann *et al.,* 2009).

By systematically analysing local climate strategies[21] (mitigation and adaptation) of the 25 largest Dutch municipalities (population over 100,000), this research aims to fill this gap. Since urban climate governance does not take place in a policy vacuum,

21 Climate strategies are often incorporated within broader sustainability strategies. However, as this article discusses climate change, we refer to climate strategies; taking note such strategies may address more than climate change.

it incorporates a multilevel perspective (Bulkeley, 2010; Gupta *et al.,* 2007; Kern, 2013). Accordingly, the research question asks: *How climate change mitigation and adaptation are anchored in the organisation, policy and practical implementation of the largest Dutch municipalities, and how do these factors, and the horizontal and vertical relations of cities, influence their performance?*

This article is broken into four sections. Section 2.2 describes theory on climate governance and indicators for the level of anchoring in organisation, policy and practical implementation and their multilevel relations. Section 2.3 describes the methodology and explores the empirical reality of Dutch municipalities, examining them based on the indicators. In section 2.4, conclusions are drawn, discussing trends of (1) *decentralisation* within municipal organisations, (2) *externalisation* of climate strategies towards private and societal actors and (3) *regionalisation* with neighbouring municipalities and the provincial government.

2.2 Anchoring of Local Climate Strategies: Conceptual Framework

The governance of climate mitigation and adaptation in cities includes local actions, as well as vertical and horizontal influences (Bulkeley, 2010; OECD, 2010). Regarding the local dimension, *NL Agency*, an agency under the Dutch Ministry of Economic Affairs[22], suggests successful execution of local climate ambitions should start with anchoring climate policy in all aspects of the organisation (NL Agency, 2011b). *Anchoring* refers to how climate policy is structurally placed within policy, organisation and practical implementation (NL Agency, 2009). Cities' performance is expected to be highest when climate strategies are well anchored in all three categories (KplusV, 2010).

2.2.1 Anchoring in Organisation

With regard to anchoring climate strategies in the municipal organisation, literature identifies six indicators to ensure sufficient anchoring. Firstly, a municipality's organisational structure, for example hierarchical levels or departments, may influence the degree to which climate strategies are integrated within the municipal organisation (Aardema and Korsten, 2009; Burch, 2010; Lenhart *et al.,* 2014; Hiemstra and Boelens, 2002; Shaw and Maythorne, 2013; Shaw and Theobald, 2011). A flat network structure in which different actors openly cooperate (so-called *directiemodel*)

22 NL Agency, an agency under the former Ministry of Economic Affairs, Agriculture and Innovation, is involved with local/regional climate policy.

is considered favourable to build trust, while encouraging dialogue and learning (Folke *et al.,* 2005; Hiemstra and Boelens, 2002; Rogers, 2009). However, Aardema and Korsten (2009) emphasise formal organisation models do not always indicate how organisations work in practice.

Secondly, the availability of a climate coordinator or manager to be aware of overall goals and link different policy fields is central for anchoring climate strategies (NL Agency, 2009). When this person has a higher position in the administration, it is assumed s/he will have power and connections, especially with top management, to incorporate climate strategies (Kern and Alber, 2009).

Thirdly, an internal steering committee at the management level can ensure tasks are well-divided, anchoring climate strategies within the administration (NL Agency, 2009). Steering committees can improve internal support and coordination among sectors (Kern and Alber, 2009).

Fourthly, there should be a clear division of responsibility within the organisation across sectors, for example appointing contact persons within each climate-relevant sector (NL Agency, 2009). If competences and responsibilities are concentrated in one department, especially a department with limited power, climate strategies may not be incorporated in other departmental strategies (Kern and Alber, 2009; OECD, 2010).

Fifthly, mitigation and adaptation should be sufficiently integrated within a municipal organisation (Klein and Huq *et al.,* 2007; Laukkonen *et al.,* 2009; Martens *et al.,* 2009; UN-Habitat, 2011; Wilson and Piper, 2010). Integrating mitigation and adaptation, often within a broader sustainable development strategy, can result in co-benefits, increasing the cost-effectiveness of particular actions, whilst making them more attractive to stakeholders and funding agencies (Klein and Huq *et al.,* 2007; Lenhart *et al.,* 2014; Laukkonen *et al.,* 2009; Wilbanks and Sathaye, 2007). By integrating both dimensions of climate policy within the administration, for example by appointing a manager who coordinates mitigation and adaptation, they can be systematically anchored (Kern and Alber, 2009).

Sixthly, structured involvement of private-sector actors, NGOs and community organisations, can facilitate cooperation between government and society to address climate change (McCormick *et al.,* 2013; UN-Habitat, 2011). Institutionalised cooperation ensures climate change remains on the local political agenda, and on the agenda of partners (Bulkeley, 2010; Klein and Huq *et al.,* 2007; Shaw and Maythorne, 2013; Shaw and Theobald, 2011).

2.2.2 Anchoring in Policy

With regard to anchoring climate strategies in policy, literature identifies four indicators to ensure sufficient anchoring. Firstly, climate mitigation and adaptation should be integrated in overarching policy documents, for example integrative climate strategies or comprehensive plans (AMICA, 2007; Klein and Huq *et al.,* 2007; Lenhart *et al.,* 2014; Shaw and Theobald, 2011; UN-Habitat, 2011; Wilson and Piper, 2010). Mitigation and adaptation should be addressed in policy plans, agreements and instruments, so the whole organisation feels ownership and responsibility (Shaw and Theobald, 2011; NL Agency, 2009).

Secondly, climate strategies should be integrated at the strategic level, in for example long-term visions (Martins and Rodriguez-Alvarez, 2007; Shaw and Theobald, 2011). Thirdly, climate strategies should be integrated at the operational level in management plans, checklists, etc., ensuring they are incorporated in short-term activities, perceived as a daily "task" (Kern *et al.,* 2009; NL Agency, 2009; Shaw and Maythorne, 2013).

Fourthly, climate strategies should be integrated in all relevant sectors' policies via "climate paragraphs" or references to climate strategies in existing documents, checklists or action-plans (e.g. planning, transport, water management, economic development) (AMICA, 2007; NL Agency, 2009; Shaw and Theobald, 2011).

2.2.3 Anchoring in Practical Implementation

With regard to anchoring climate strategies in practical implementation, literature identifies five indicators to ensure good anchoring. Firstly, practical implementation requires internal support from employees and appointed officials within an organisation to make climate policy a success (Burch, 2010; Shaw and Theobald, 2011). An enthusiastic mayor or alderman (in the Dutch case) who supports climate policies may serve as an example, internally and externally (Bulkeley, 2010; Lenhart *et al.,* 2014; McCormick *et al.,* 2013).

Secondly, effective practical implementation of climate strategies requires external cooperation with key stakeholders, including universities, energy or waste companies and NGOs (Bulkeley, 2010; McCormick *et al.,* 2013; NL Agency, 2009; Shaw and Theobald, 2011). Together these stakeholders can facilitate outreach of climate policy, anchoring climate strategies within a municipality's activities (Fünfgeld, 2010; Klein and Huq *et al.,* 2007; Lenhart *et al.*, 2014).

Thirdly, societal support is an important precondition for practical implementation of local climate strategies (Klein and Huq *et al.,* 2007; McCormick *et al.,* 2013; McEvoy *et al.,* 2006; Shaw and Theobald, 2011). Many climate strategies' effectiveness depends upon consumer choices and citizen engagement (McEvoy *et al.,* 2006). Within the "energetic society" concept, everybody feels problem ownership and initiatives come from all parts of society (*Klimaatcongress*, 2011).

Fourthly, practical implementation requires capacity and resources, including manpower, knowledge, skills and finances, without which climate policy is constrained (Burch, 2010; Fünfgeld, 2010; NL Agency, 2009; Saavedra and Budd, 2009; Satterthwaite, 2008; Wilbanks, 2005).

Finally, monitoring is considered a precondition for effective practical implementation of climate strategies to follow progress of policy implementation, or alter a particular policy if needed (Burch, 2010; Fünfgeld, 2010; Folke *et al.,* 2005; NL Agency, 2009; Saavedra and Budd, 2009).

2.2.4 Local Authorities in a Multilevel System

The local dimension, as discussed above, functions within a broader multilevel governance system, including vertical and horizontal relations (Bouteligier, 2012; Hooghe and Marks, 2001; Kern, 2013; OECD, 2010; van Bommel and Kuindersma, 2008). Vertical relations refer to interactions with higher government levels, such as regional/ provincial authorities, national authorities and the European Union (Bulkeley, 2010; OECD, 2010). Higher government may offer support for local climate strategies, via subsidies, legal support or policy guidance; they also influence the extent to which cities are granted autonomy to create and govern their own local climate strategies (Baker and Eckerberg, 2007; Bulkeley and Betsill, 2003; Bulkeley, 2010; Corfee-Morlot *et al.,* 2009; Kern and Alber, 2009).

Horizontal relations refer to interactions with (trans)national city networks (Bouteligier, 2012; Bulkeley, 2010), as well as regional interactions with neighbouring cities, referred in this article as regionalisation. Horizontal relations offer opportunities for learning and dialogue via partnerships, technical support as well as lobbying on behalf of cities at (inter)national levels (Granberg and Elander, 2007; Kern and Bulkeley, 2010; Schreurs, 2008).

Based on the above literature, 17 indicators were identified to assess the level of anchoring in organisation, policy and practical implementation, and multi-level relations (see Table 2-1).

2.3 Climate Change Governance in Dutch Cities: Empirical Results

2.3.1 Methodology

To assess anchoring of climate strategies in Dutch cities, information was obtained from municipal reports, policies and websites. In October 2011, in-depth interviews were conducted with experts at relevant ministries and city networks, such as NL Agency and *Klimaatverbond*, to confirm findings from literature and policy documents, and to provide guidance for the data collection procedure. In November 2011, representatives of 25 (out of 26) Dutch municipalities[23] (with over 100,000 inhabitants) were interviewed in a one-hour telephone interview, based on the formulated indicators as presented in Table 2-1. Interviews were conducted with the person in charge of climate policy.

With regard to performance, output and outcome performance can be distinguished. *Outputs* are tangible policy measures, such as road taxes or a subsidy for green roofs. *Outcomes* are results attributed to policy implementation, such as the effects of a strategy on a target group, for example reductions of CO_2 emissions or flood risk (EEA, 2001; Kern and Alber, 2009). As outcome performance cannot be assessed in a systematic way due to a lack of data[24], this study focuses on output performance, including a comparative self-assessment of the cities. Participating cities were asked to assess their own performance and the performance of other cities, specifically cities they consider national forerunners from which they can learn.

With information collected during interviews, Amsterdam, Rotterdam, Den Haag and Tilburg were identified as best-performing cities: they were mentioned most often by other cities and considered best practice regarding e-mobility, adaptation and sustainable energy (see Table 2-2 for ranking). This was consistent with other rankings[25] that highlight these four cities as Dutch forerunners. These four cities, referred to as reference cities, are analysed in greater detail. More information on the reference cities can be found in Table 2-4.

23 Arnhem declined to participate in the study.

24 Existing tools, like climate monitor (*klimaatmonitor*) do not evaluate/compare performance of Dutch municipalities in a systematic way (NL AGENCY. 2011b. *Klimaatmonitor* [Online]. Available: http://www.klimaatmonitor.databank.nl/ [Accessed 09-2011].

25 E.g. sustainability ranking ("*Duurzaamheidsmeter*") from COS Nederland (2009) or climate monitor ("*Klimaatmonitor*") from NL Agency; http://www.iclei-europe.org/members/member-in-the-spotlight/archive/rotterdam/; http://www.iamsterdam.com/en-GB/Eco-Cluster (see facts and figures)

Table 2-1 Indicators: Anchoring in Organisation, Policy and Practical Implementation

Indicator[26]	All 25 cities	Reference cities			
		Amsterdam	Rotterdam	Den Haag	Tilburg
Anchoring in organisation					
1. Model of municipal organisation ("direction/ network" structure)	~	~	~	~	+
2. Position (formal power) of climate coordinator	-/+	+	+	-	-
3. Internal climate steering committee	-/+	+	+	+	-
4. Responsible persons in different departments and division of responsibilities	-/(+)	-/+	+	-	+
5. Integration of mitigation and adaptation in the organisation	-	-	+	-	-/+
6. Structural private involvement	(-)/+	+	+	+	+
Anchoring in policy					
7. Integration of mitigation and adaptation in policy documents	-/+	-/+	+	+	+
8. Long-term/ strategic climate mitigation and adaptation policies	+	+	+	+	+
9. Short-term/ operational climate mitigation and adaptation policies (action plans)	-/(+)	-/+	+	+	(-)/+
10. Integration of climate mitigation and adaptation in different sector policies	-/+	+	+	+	+

26 Rankings are indicated as: "-" refers to low anchoring; "-/(+)" refers to low to medium anchoring; "-/+" refers to medium anchoring; "(-)/+" refers to above medium anchoring; and "+" is high anchoring.

Table 2-1 Continued

Indicator	All 25 cities	Reference cities			
		Amsterdam	Rotterdam	Den Haag	Tilburg
Anchoring in practical implementation					
11. Internal support (college and council)	+	+	+	+	+
12. External cooperation	+	+	+	+	+
13. Societal support	-/+	+	+	+	?
14. Capacities (manpower, knowledge, skills, finances)	-/+	+	+	(-)/+	+
15. Monitoring and evaluation	-/+	+	+	-/+	+
Multi-level relations					
16. Vertical interactions	+	+	+	+	+
17. Horizontal interactions	+	+	+	+	+

Table 2-2 Reference Cities' Ranking: Tilburg, Amsterdam, Den Haag, Rotterdam

Ranking	Cities seen as forerunners
1. Tilburg	Mentioned by 13 cities as leader in for example local action (e.g. sustainable building; sustainable lighting) and sustainable energy production (e.g. wind and bio energy)
2. Amsterdam	Mentioned by six cities as leader in for example financing structures (revolving funds, e.g. for energy saving measures), electric mobility (many charging points and other stimulating measures) and sustainable energy production
2. Den Haag	Mentioned by six cities as leader in for example: climate funding, geothermal energy, solar energy
4. Rotterdam	Mentioned by five cities as leader because of their active programme bureau resulting in innovation and many adaptation activities (e.g. flood management, adaptive building, storm water storage, etc.)

All 25 cities developed citywide emission reduction goals; 15 cities committed to become climate-neutral. However, their target years vary. With respect to adaptation, only Rotterdam, Den Haag and Tilburg have clear goals (e.g. "100% climate proof") (Table 2-3).

2.3.2 Anchoring in Organisation

With regard to anchoring in organisation, the study led to the following results:

- different cities have different organisation models. Some introduced a "direction/ network" structure in their municipal organisation (indicator 1);
- all cities have a programme office, a programme manager or coordinator in charge of climate strategies, but only in one-third of cities do these persons hold a higher position (indicator 2);
- one-third of cities have an internal steering committee (indicator 3);
- only in a few cases are persons from other departments, aside from the coordinating department, designated for climate strategies (indicator 4);
- mitigation and adaptation are most often not organised in a coordinated way (indicator 5);
- formal structures for private involvement are found in two-thirds of cities, others prefer *ad hoc* cooperation (indicator 6).

Based on the formulated indicators, anchoring in organisation is considered low to medium (-/(+)) (Table 2-1). The reference cities score better on anchoring in organisation, mainly through having an internal steering committee and structured public-private partnerships (PPPs) (see Table 2-4).

In the Netherlands there are no national guidelines for the organisation of climate policy. Consequently, Dutch cities have chosen different options, such as: a programme office (Amsterdam, Rotterdam); a programme manager with a high position in the organisation (Utrecht, Eindhoven); a programme manager with a programme team (Utrecht, Zoetermeer); a hybrid organisation with programme actions and line actions (Haarlem); or low anchoring, in terms of formal power or responsibility, but with a specific work culture. Some municipalities try to relinquish control, acting as an equal partner; others prefer a more active steering role. There is no one-size-fits-all model. Different opinions exist in the 25 cities regarding the optimal solution for organising climate policy.

When looking at the indicators it was said that the possibility of creating internal support and thus of anchoring climate strategies, depends on the model of municipal organisation (indicator 1). Most interviewees agree: the physical location of the "climate core" is important. Even when a separate programme office exists, as in Amsterdam and Rotterdam, being physically located in a department with relevant people is helpful. In Leiden, a separate Environmental Execution Office (*Milieudienst*) coordinated all mitigation tasks. Consequently, within the municipal administration there is only a moderate interest for the topic and internal involvement is low. Contracting out too many tasks can lead to low anchoring of climate strategies.

Table 2-3 Climate Goals of Dutch Cities

	City	Inhabitants (April 2011)	Mitigation Targets on CO_2 reduction in percentage (for entire municipality)
1	Amsterdam	783.364	40% / 75%
2	Rotterdam	611.495	50%
3	Den Haag	496.745	100% CO_2 neutral
4	Utrecht	312.634	100% climate neutral
5	Eindhoven	216.157	100% energy neutral
6	Tilburg	206.186	100% CO_2neutral
7	Almere	191.239	100% energy neutral
8	Groningen	190.334	100% CO_2 neutral
9	Breda	174.829	100% CO_2 neutral
10	Nijmegen	164.540	100% energy neutral
11	Enschede	157.587	30%
12	Apeldoorn	156.355	100% energy neutral
13	Haarlem	150.744	100% CO_2 neutral
14	Zaanstad	147.141	100% CO_2 neutral
15	Amersfoort	146.889	100% CO_2 neutral
16	Haarlemmermeer	143.484	30%
17	‘s-Hertogenbosch	141.134	100% Climate neutral
18	Zoetermeer	121.964	100% CO_2 neutral
19	Zwolle	120.661	20%
20	Maastricht	119.623	100% Climate neutral
21	Dordrecht	118.906	100% Climate neutral
22	Leiden	117.914	21%
23	Emmen	109.244	100% CO2 neutral
24	Ede	108.255	20%
25	Venlo	100.301	100% Climate neutral

By year (1990 as baseline)	Mitigation Targets in their municipal organisation	Adaptation Targets
2025 / 2040	CO_2 neutral by 2015	
2025		100% climate proof in 2025
2040	Climate neutral by 2010	100% climate proof in 2040
2030 (baseline 2010)	CO_2 neutral by 2012	
2035		
2045	CO_2 neutral by 2015	100% climate proof in 2045
2025		
2035		
2044	CO_2 neutral by 2020	
2032	CO_2 neutral by 2015	
2020	CO_2 neutral by 2015	
2020 built env. 2025 companies 2035 traffic	Energy neutral by 2020	
2030	CO_2 neutral by 2015	
2020		
2030	CO_2 neutral by 2011	
2020	CO_2 neutral by 2015	
2045	Climate neutral by 2020	
2030		
2020		
2030	Climate neutral by 2015	
2050		
2030	Climate neutral by 2015	
2030-2050		
2020		
2030	Climate neutral by 2015	

Table 2-4 The Reference Cities of Tilburg, Amsterdam, Den Haag and Rotterdam

City	Climate policy coordination	Organisational structure
Amsterdam	Programme Office Climate and Energy (*Klimaat en Energie*)	Climate Council (*Klimaatraad*) • steering group of climate ambassadors for companies, knowledge institutes, societal organisations; • meets twice a year; meetings on flexible basis for specific topics; • discusses policy and advises city; • flexible cooperation structures depending on topic.
Rotterdam	Programme Office Sustainability *(Programmabureau Duurzaam)*	RCI (Rotterdam Climate Initiative): Public-Private Partnership of City of Rotterdam, Environmental service (*milieudienst*), harbour company (*havenbedrijf*) and Deltalinqs; • RCI steering group: mayor, aldermen, RCI manager, environmental director, harbour company director, Deltalinqs chair; • Market Steering Group Sustainable Development (Marktstuurgroep Duurzaam ontwikkelen); several market actors and municipalities meet once per month; • Recommendation Committee (*Commitee Aanbevelingen*)
Den Haag	Climate coordinator in Maintenance Department *(Stadsbeheer)*	Advisory Board (*Overlegtafel klimaat*) + Sustainability Platform (*Platform Duurzaamheid*) • steering group of environmental organisations, energy companies, knowledge institutes etc. • sustainability platform for big companies • plans to create sustainability centre to broaden and centralise external contacts
Tilburg	Programme manager, Climate and Energy (*Klimaat en Energie*) Climate team in policy development section of the Environment Department	"*Klimaatschap*" with climate office (*Klimaatbureau*), alliances as well as the Climate Advisory Council (*Klimaatadviesraad*) • plans to place the climate office (*Klimaatbureau*) outside municipal organisation; • plans to link up to *MidPoint Brabant* (regional economic cooperation programme for social innovation, led by education, organisation and government representatives); • Energy and sustainability development company (*Midden-Brabantse Ontwikkelingsmaatschappij voor Energie en Duurzaamheid*) within *MidPoint* is under construction; this is a PPP for sustainable energy production.

Main policy documents	FTE (fulltime equivalent) for climate policy	Horizontal interactions
• Energy Strategy 2040 • Sustainability perspective 2040	7 fte (but every district in Amsterdam has 1-2 climate coordinators)	G4 (four largest Dutch municipalities), thematic teams, ICLEI-CCP, C40
• Sustainability Programme 2010-2014*(Programma Duurzaam)* • Other climate documents	23 fte (for mitigation, adaptation and regular environmental tasks)	G4, thematic teams, ICLEI-CCP; C40, CDC
• Framework Programme Sustainable Development 2009 • Climate Plan Den Haag • Energy Vision 2040	4 fte	G4, thematic teams, Climate Alliance
• First Climate Programme Tilburg for a Climate Neutral and Climate Proof City (2009-2012)	5-7 fte	Regional (B5, *MidPoint Brabant*); ICLEI-CCP

Interviewees were asked whether a coordinator or programme manager placed closer to a director or alderman results in more (symbolic) power (indicator 2). Even the reference cities have different solutions. Some cities value having the programme manager high in the administration, others place greater emphasis on support and cooperation. Having someone with a high position does not always lead to more action on the ground because formal power is not always utilised, for example when power to steer is not common in a municipality's culture. Internal support from other civil servants may be more important for performance than formal power, since municipalities agree sustainable thinking should be common property in the whole administration. This internal support can be stimulated by an internal steering committee (indicator 3), which one-third of municipalities have established.

The idea to anchor climate policy in all parts of the organisation resulted in discussions on the (dis)advantages of appointing responsible persons in all relevant departments (indicator 4). Having a core team of administrators located in different departments may improve integration because it creates internal support and facilitates internal coordination via joint-meetings and monitoring. Still, expert interviews suggest there remains inadequate integration in sectoral policy, including within the housing, transport and economic development sectors. Since addressing climate change is regarded as a "general task", some municipalities prefer not to appoint officers in all relevant departments. Other municipalities prefer to integrate climate strategies in relevant departments' work without formal responsibility. Some interviewees remark however, making climate strategies a voluntary task may lead to their dismissal.

Many cities admit that anchoring climate strategies in all parts of the organisation, including relevant sectors and departments, is a real challenge. The same applies to the organisational integration of mitigation and adaptation (indicator 5). Clear coordination or having an overarching programme office, such as in Rotterdam, appears to make adaptation strategies less *ad hoc*. Still, few cities have opted for structural integration of mitigation and adaptation.

In general, interviews demonstrated that all cities regard their climate organisation as "temporary". In other words, interviewees assume their current structure for organising climate strategies will eventually no longer be necessary, indicating that all municipal departments, societal and market actors should contribute to climate strategies. In addition, a trend towards decentralisation within the municipal organisation is evident; some municipalities have already reduced their central climate coordination. While this situation is questioned by some cities, others may follow a similar plan and decentralise their climate coordination after a period of central steering. Groningen, for example, purposely lacks a central climate coordination office, to highlight that

climate strategies are important for, and should be addressed by, everyone in the municipal organisation. Groningen however doubts the effectiveness of this method. Although a city's role and the organisation of its climate strategies may change, it will remain necessary to monitor progress or focus on upcoming topics.

A municipality's internal organisation should align with external cooperation, including structured involvement of other actors to anchor climate strategies (indicator 6). Two-thirds of cities have developed formal structures for PPPs. Notably all reference cities have an external steering group with a broad range of partners and structural cooperation (see Table 2-4). This is perhaps a prerequisite for better performance. When *ad hoc* cooperation prevails, climate strategies are less anchored because continuation is not ensured.

Aside from increasing cooperation, a trend towards externalisation is evident; i.e. there is a tendency to place climate coordination outside the municipal administration. This demonstrates being "open for society", preventing other actors from assuming the municipality will take the lead. It is, however, debated whether the municipal administration should delegate and externalise all of its climate policy tasks, in particular in the absence of societal initiatives. Unfortunately, the existing cases (Tilburg, Almere) cannot yet be evaluated; this is a very recent development. It can be assumed that externalisation has positive effects if a culture of sustainability is already rooted in society. While this is the case in some municipalities, it does not account for all. The bonds with the municipal administration thus should not be overly weakened. It was also acknowledged that the more you place tasks outside a municipality, the more difficult it is to maintain internal support. A proper balance should be found between internal and external anchoring of climate strategies. A strong and active municipal organisation will remain important, also in future.

Consequently, no uniform trend manifests with respect to anchoring climate policy in organisation. Differences exist with regard to the six indicators for organisational anchoring. Cities can learn from the reference cities on anchoring their climate strategies, including creation of a central coordination point for climate strategies and focussing on structured PPPs.

2.3.3 Anchoring in Policy

With regard to anchoring in policy, the study led to the following results:

- ❖ mitigation and adaptation are integrated in policy documents to a medium degree (indicator 7);
- ❖ all cities set long-term goals (see Table 3) and many developed long-term/ strategic documents – especially for mitigation (indicator 8);
- ❖ action plans are available for less than one-third of cities (indicator 9);
- ❖ more than one-third of cities try to integrate climate strategies (often only mitigation) within other sector policies, plans or projects (indicator 10).

Based on the formulated indicators, anchoring in policy is medium (-/+) (see Table 2-1). The reference group scores higher than average on all indicators, except for long-term policy (indicator 8), which was sufficient in all cities. Although the necessity of anchoring in policy is not seen by all cities, the reference cities take anchoring in policy more seriously. Their efforts to integrate mitigation and adaptation in policies, together with action plans and the integration of climate strategies in sectoral policies, may explain the better performance of the reference group (see Table 2-4).

While in some cities mitigation and adaptation are clearly two separate tracks, others actively try to integrate them, or combine them in sustainability documents (indicator 7). However, in most cities adaptation strategies are still in a preliminary phase, except for water management. If adaptation strategies are implemented, this occurs *ad hoc*, especially for sectors other than water management. Perhaps in the future, more municipalities will conduct research on adaptation, formulate long-term goals and translate them into action plans.

Strategically, climate strategies are sufficiently anchored (indicator 8), notably concerning mitigation. Operationally however, less than one-third of cities have everything included in action plans (indicator 9). Many cities have not translated their long-term goals into short-term goals and actions. More operationalised plans could better anchor responsibilities within the whole administration, making climate strategies less voluntary. With clear short-term plans, it is easier to monitor progress, or steer in a different direction if needed, to reach long-term goals.

Concerning formal integration of climate strategies within other sectoral policies (indicator 10), over one-third of municipalities value inserting “climate paragraphs” in either projects or policies. Climate strategies can also be integrated within other sectors’ on-going work without being formally anchored in sectoral policies, for example via workshops or multi-aspect design programmes. According to expert

interviews with experts from the national government (NL Agency) and a Dutch city network on climate change (*Klimaatverbond*) integration of climate strategies in different policy areas remains inadequate.

2.3.4 Anchoring in Practical Implementation

With regard to anchoring in practical implementation, the study led to the following results:

- the level of internal support (college, council) is high (indicator 11);
- there is a high level of external cooperation (indicator 12);
- societal support varies among cities (indicator 13);
- capacity differs considerably, not always linked to city size (indicator 14);
- many municipalities struggle with monitoring (indicator 15).

Based on the formulated indicators, anchoring in practical implementation is high medium ((-)/+) (Table 2-1). In terms of engaging private sector and societal actors, the reference cities benefit from active engagement and established cooperation structures, such as local covenants. While other municipalities are starting to initiate structural cooperation, the reference cities are extending their structural cooperation to engage new and additional parties. It may be that resource capacity and manpower in the reference group helped to reach this stage. Still, manpower in the reference group varies; it is not necessary to have 23 fulltime equivalents like Rotterdam to become a frontrunner (see Table 2-4). The reference group, save Den Haag, also scores higher on monitoring and evaluation (indicator 15). The introduction of monitoring systems demonstrates how serious the reference cities consider climate change and aim for continuous improvement.

The level of internal support (indicator 11) is high in most cities, but mainly for mitigation. Adaptation does not yet receive attention from top management or political support. External cooperation (indicator 12) is also high. In almost all cases, external cooperation is mentioned as the most important implementation factor. Some developed a broad cooperation network, sometimes with cooperation strategies actively launched, for example through covenants.

Cooperation also derives from societal-led initiatives (indicator 13), such as the emergence of neighbourhood energy cooperatives. Cooperation with knowledge institutes is increasing, as are initiatives for sustainable hubs to facilitate interaction between different partners. Differences between cities exist because cooperation can be either more structured or more ad hoc (see anchoring in organisation).

There were differences found in capacity among cities (indicator 14). All cities, however, expect future capacity to diminish due to national and local budget cuts for local climate strategies, especially affecting smaller cities. In such cities climate change may be completely removed from the agenda; these municipalities will likely only meet national obligations (e.g. in relevant sectoral strategies).

Some cities use citywide monitoring (indicator 15), but struggle to obtain sufficient data to get a complete picture. Others focus on project monitoring and search for workable indicators. Project monitoring should be conducted throughout a project, since monitoring requires systematic and timely gathering and organisation of data. While action is key, assessing and understanding the results can improve organisational anchoring and actions. Still, many cities do not monitor their progress systematically.

2.3.5 Local Authorities in a Multilevel System

With regard to vertical interactions (indicator 16), interviewees acknowledged a shift in the roles different government levels play. Currently, climate policy is less prioritized by the national government[27] and the Netherlands lost its former forerunner status regarding national support of local climate policy. Although previously, national government played an important role to encourage the development of municipal climate policies, cities now see national government (*Rutte I*) as a hindering factor. Consequently, cities do not feel sufficiently enabled by national government; they feel rather left alone. Firstly, national subsidy schemes to support municipal climate strategies (BANS and SLOK)[28] that included a combination of financial provision and knowledge support, have ended and will not be extended or replaced. Smaller municipalities like Maastricht, Dordrecht and Ede perceive the end of subsidy schemes as a barrier. Secondly, the unstable ambitions of national government, in particular decreased support and guidance provided to municipalities from national agencies such as NL Agency, have negative impacts and de-incentivise local action. Thirdly, cities mention that legal barriers, for example with regard to minimum energy requirements in the *Building Decree*[29], are not removed as quickly as promised by national government. Thus, national government does not oblige comprehensive climate policies; rather it diminishes municipalities' freedom to act.

27 When the research was conducted, the Netherlands was governed by Rutte I, which was replaced by Rutte II in November 2012.

28 BANS: *Bestuursakkoord Nieuwe Stijl* (New Style Management Agreement); SLOK: *Stimulering LOkale Klimaatinitiatieven* (Promotion of local climate initiatives).

29 Due to changes in the Building Decree (*Bouwbesluit*), local authorities cannot require more than national minimum requirements for building and energy efficiency, thus limiting more ambitious local authorities.

The above challenges are combined with a trend of decentralising tasks from higher government to municipalities. According to cities, this is not combined with (enough) support or authority. *Green Deals*[30] or arrangements between individual municipalities and national government, provide some support, but are not equally accessible to all. Green Deals may create a selective impact, leading to polarisation between forerunners and laggards.

Other government levels may become more important. Currently, interviewees mentioned provincial government (the region) as an important player in areas such as sustainable energy, but also for lobbying, in particular now that the role and actions of national government are questioned. According to interviewees, provinces are better trusted and, although not offering financial support, they play an important role in organising and stimulating regional interactions.

Similarly, the EU has become an actor of increasing importance. In contrast to provinces and national government, the EU still offers financial support for climate action. EU subsidies may be increasingly sought by Dutch cities, at least by those with sufficient capacity to apply for funding.

With regard to horizontal influences (indicator 17), a regionalisation trend becomes evident from the interviews. For mitigation strategies, a transition from participation in transnational city networks to more regional networks like *Energy Valley, Stedendriehoek* and *MidPoint-Brabant* and topic/project networks is witnessed. Larger cities, with a history of internationalisation and participation in transnational networks, maintain an international focus. Smaller cities often do not have capacity for internationalisation; they can, however, learn from regional forerunners who participate in transnational networks. Strong regional networks among local authorities in a metropolitan region can facilitate cooperation with other government levels, or improve chances of receiving EU funding. Provinces play an important role in promoting such regionalisation.

For adaptation, a trend towards regionalisation is also relevant. Adaptation strategies have a focus on regional cooperation as well as international collaboration, for financial support and learning. However, in many cities, adaptation strategies are still in an early phase and limited to water management. Perhaps by working with regional and international partners, cities will broaden adaptation strategies to include disaster planning, health issues, etc.

30 *Green Deals*, initiated by Rutte I, operate on a project level, instead of a comprehensive approach.

2.4 Conclusions

Examining the research question from a general perspective, it can be concluded that most cities have not systematically integrated mitigation and adaptation in climate organisation or policy. There is however a tendency of placing climate mitigation and adaptation strategies within broader sustainability programmes. This seems promising since sustainability addresses more issues than climate change; under this overall umbrella synergies can be sought between mitigation, adaptation and other relevant policy areas. Since sustainability is a widely interpreted concept, operationalisation and having clear indicators for monitoring is important, to make improvements possible and prevent sustainability from becoming too vague.

As this study conducted a broad overview of climate strategies in the largest 25 Dutch municipalities, a reference group (of Amsterdam, Den Haag, Rotterdam and Tilburg) was selected to explore the study in further detail. This reference group achieved a higher score on almost all indicators for anchoring. Their experiences could be utilised in other cities to anchor climate strategies. The reference group shows, for example, that cities can strengthen their internal organisation by having a central coordination point for climate strategies, such as a programme office, a programme manager or coordinator. The references group also benefits from having a core climate team with members located in different departments to facilitate citywide and sectoral integration across departmental lines.

From this research it became clear that city performance should be understood from a broader multilevel perspective. One of the main challenges facing Dutch cities is to guarantee continuation of successful climate actions, despite budget/ subsidy cuts. Moreover, according to cities, national government has shifted its position on climate change, reducing its importance as a policy priority. While larger cities can apply for EU funding and knowledge sharing, others lack capacity or experience to do so.

From this study, we also witness several emerging trends influencing local climate strategies, notably: (1) *decentralisation* of climate strategies within a municipal administration, wherein climate strategies are integrated across relevant sectors and departments; (2) *externalisation* of climate strategies, including broader methods to engage a wider group of non-public actors to steer local climate strategies; and (3) *regionalisation* of climate strategies wherein municipalities in a wider region work together on joint-strategies and learning.

Firstly we witness a trend of *decentralisation*. While most cities still have their climate strategies centrally organised within the municipal administration, all 25 municipalities

work towards internal decentralisation of their climate strategies, from a single coordinating department to multiple departments engaged in climate-relevant concerns. Most municipalities thus perceive their climate organisation as temporary, until climate goals are embedded in all parts of the administration. To reach climate neutrality, it is assumed the whole municipality, and all relevant departments, should work together on the topic. It is, however, expected that a combination of centralisation and decentralisation will be most effective also in the future, on complex challenges like climate change. New topics will arise that need to be coordinated, researched and structurally placed within the administration. Coordination is also necessary for monitoring and continuous improvement. The ideal combination is thought to consist of central steering with a decentralised team, located in different departments, to facilitate integration.

Secondly we witness a trend of *externalisation* of various degrees. This can start with structured inclusion of PPPs to encourage stakeholder involvement and sharing responsibilities on climate strategy development and practical implementation. This is something the reference cities excelled at. More cities look for additional partnerships, including with new actors, such as knowledge institutes and insurance companies, to involve them in climate strategies. Some municipalities opt to relinquish considerable control over climate strategies, working towards full externalisation, wherein climate strategies are placed outside the municipal administration and pulled by external partners. This is not only due to the complexity of climate change, but also due to current budget constraints and expiring subsidy schemes. Unfortunately there are not yet mature examples where a city has fully externalised its climate strategies. Currently, most cities still maintain an active steering role. It is assumed this will remain necessary in the future. A strong external structure should be balanced with a strong internal structure – combining centralisation and externalisation – to "let things go" while maintaining a steering role and capacity to start initiatives when necessary.

Thirdly we witness a trend of *regionalisation*. This includes forming regional cooperation structures, which may provide new opportunities to integrate climate strategies. Due to decreasing capacity at the municipal level and the current focus on action, cities focus on the regional level for cooperation, in particular regarding mitigation. Regional cooperation between municipalities, often stimulated by provinces, offers new opportunities for joint funding and joint learning. By forming regional networks around frontrunners and internationally oriented cities, frontrunners can share knowledge with neighbouring cities, stimulating them to enhance their climate strategies. Moreover, a focus on regional cooperation may improve capacities to apply for EU funding or via the Dutch Green Deals. This may be the only option for smaller municipalities to engage in such funding schemes in the future.

Overall, the 25 cities have a structured approach to cope with climate change. They do not only apply no-regret measures on a case-by-case basis; but instead they engage in a large range of activities. Still, for many cities, integrating climate strategies in the whole administration remains a struggle. Although some appear “on schedule”, many cities remain in the initial transition phase. While the austerity of Dutch politics and the financial crisis make it difficult to keep climate change on the agenda, these circumstances may encourage cities to invest in a strong and effective climate organisation within a city, with its neighbouring cities, and external partners.

3

Cities as Learning Organisations in Climate Policy: the Case of Malmö[31]



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Abstract

The complexities and uncertainties inherent to climate change place ecosystems and governance systems under pressure, in particular at the local level where the causes and consequences of climate change play out. To address this complexity, local authorities have to be flexible, with an emphasis on learning and experimentation to lower greenhouse gas emissions and adapt to the challenges climate change poses – hence, they have to become learning organisations. Examining Malmö, this paper explores whether it has the characteristics to embrace and institutionalise learning and how this affects the development of its climate policies. The analysis finds several elements invaluable for Malmö's innovative climate policies: climate strategies are incorporated within the city's long-term vision to become a sustainable city: socially, economically and environmentally; dialogue and learning are emphasised throughout the process; and all stakeholders are involved, including external partners, leading to integrated approaches.

3.1 Introduction

While actions are needed at various levels to address climate change, urban areas are crucial. For the first time in history, more than 50% of humanity reside in urban areas, altering the relationship between humans and nature: modern cities are defined by a concentration of economic activity, infrastructure and intensive human interaction (UNFPA, 2007). Despite benefits, urban areas constitute 40- 70% of global greenhouse gas (GHG) emissions (IEA, 2008; UN-Habitat, 2011)[32]. Cities, however, not only generate emissions, but also strategies to mitigate climate change via policies, technical investments and communication (Hoornweg *et al.,* 2011; Kern and Alber, 2008; UN-Habitat, 2011). In fact, per capita emissions of many cities are lower than their national average (Dodman, 2009; Liu *et al.,* 2012).

While mitigation has long been on the research and policy agenda, emission reduction strategies have not unfolded quickly enough; adaptation to the short and long-term vulnerabilities of climate change thus becomes a necessary complement to mitigation (Martens *et al.,* 2009; McEvoy *et al.,* 2006; McEvoy *et al.,* 2010; UN-Habitat, 2011). While mitigation and adaptation strategies differ in terms of spatial and temporal scales and institutional contexts, it is increasingly recognised that integrated mitigation-adaptation strategies, taking vulnerability and a long-term sustainable development perspective into account will be required (Klein and Huq *et al.,* 2007; Martens *et al.,* 2009; Wilbanks and Sathaye, 2007). This is all the more relevant in cities, which both contribute to climate change, and are already vulnerable to the consequences. Cities include wide expanses of non-porous surfaces, exacerbating flood risk and urban heat island. Moreover extreme weather events can lead to temporary or prolonged urban resource demands (e.g. energy and water), weaken urban infrastructural networks or endanger historic architecture (Carter, 2011; da Silva *et al.,* 2012; UN-Habitat, 2011). Within cities, integrative climate policies, planning and design strategies can facilitate more efficient use of urban services and natural resources, while addressing vulnerability and improving quality of life (e.g. air quality, reduced travel time) (Carter, 2011; Klein and Huq *et al.,* 2007; Martens *et al.,* 2009; McCormick *et al.,* 2013).

Although local authorities are not the only actor(s) to consider in urban climate governance, they remain significant (Bulkeley and Castán-Broto, 2012; Kern and Mol, 2013; McCormick *et al.,* 2013; UN-Habitat, 2011). They are, at least traditionally, responsible for coordinating urban planning and design, transportation, building and

32 Debates remain on how this is calculated (consumption or production). Cities are often more efficient than suburban/rural areas at similar affluence levels (Dodman, 2009).

construction – all relevant sectors for mitigation and adaptation (McCormick *et al.,* 2013; Wilson and Piper, 2010). Furthermore, the response capacity and ensuing policies to address climate change depend on specific local conditions and organisational elements (Burch, 2010; Tompkins and Adger, 2005). Due to multiple complexities and uncertainties, addressing urban climate challenges is not the unfolding of a one-time implementation plan; rather, urban climate policies need to be adaptive and flexible (McEvoy *et al.,* 2010). Local authorities must tackle the inter-dependencies and interactions between different actors and actions, adopting an institutionalized ability to continuously learn and change with respect to climate change – they have to become learning organisations (Senge, 1990). A focus on learning can support urban climate governance and the adoption and implementation of urban climate strategies. Learning thus serves as a focal element in this paper.

This paper investigates if a particular local authority reflects the characteristics of learning organisations (Senge, 1990) and if so, how this facilitates an adaptive[33] climate policy. To explore the value of learning organisations in urban climate governance, an in-depth analysis was conducted of a city regarded as a sustainability forerunner: Malmö, Sweden (recognised by European Commission's 2012 *RegioStars Award* for integrated sustainable development strategies, *Idébanken's* 2011 prize for long-term efforts to become a sustainable city, WWF's 2011 *Earth Hour Capital*, etc.[34]) In addition to its achievements, Malmö has faced struggles. Previously an industrial city, Malmö suffered an economic collapse in the late 1980s. This crisis provided city leaders an opportunity to redirect Malmö's identity and policies, learning to adapt from industrial development to sustainable development. Malmö's organisational structure and relevant climate policies are investigated through an analysis of policy documents, grey literature, participatory observation (e.g. participation in internal, cross-departmental and partner meetings, conferences and workshops)[35] as well as ten interviews conducted with representatives from the Environment Department, City Planning Office, City Hall and the Streets and Parks Department. The analysis of a single case study is limited when it comes to generalizable results, but has the advantage that it can be conducted in much detail (Yin, 2009). Studying a forerunner

33 Adaptive, in this context, refers to the ability to adjust to emerging situations, including climate change, including technical and economic resources, human/social capital and governance schemes (Martens *et al.,* 2009).

34 Other acknowledgments include: first (of 800 projects) in European Campaign for Take-off for Malmö's "*City of Tomorrow: 100% Local Renewable Energy*" (2000); *Design Prize* winner (2005); *Liveable Communities Award* winner (London, 2007); featured in State of the World Report (WWI, 2007); World's 13 most creative cities (Fast Company, 2009); *BEX Award for Best Master Plan* (World Green Building Council, 2009); *Sweden's Most Sustainable City* 2010 (*Miljöaktuellt*); and national recognition for cycling and sustainable procurement (2012).

35 The lead author previously worked for Malmö's Local Authority, providing in-depth understanding of its climate and sustainability strategies, including organisational elements.

is also relevant from a policy perspective (Flyvbjerg, 2004). Other cities may learn how Malmö, adopting the structure of a learning organisation, is able to cope with the uncertainties and complexities of climate change.

This paper is divided into four sections. Section 3.2 applies Learning Organisation Theory to develop a conceptual framework for adaptive climate governance of local authorities. Section 3.3 investigates to what extent Malmö's local authority has adopted the characteristics of a learning organisation concerning the development and implementation of its climate policies. Main findings are discussed in Section 4.4.

3.2 Addressing Climate Change at the Local Level through Learning

Local authorities have long been called upon to modify their structure, competencies and responsibilities to provide services and address challenges (Wollmann, 2004). In the 1980s, New Public Management (NPM) attempted to modernise the public sector along three lines: lean government, introduce private-sector management principles and enhance innovation and flexibility of local leadership (Wollmann, 2004).[36] NPM has faced criticism concerning its emphasis on market rules, reducing local governments' ability to regulate (Rose and Ståhlberg, 2005; Katusiimeh *et al.,* 2012). Meanwhile, local authorities moved from a regulatory/service provision role to an enabling role (Betsill and Bulkeley 2006, Bulkeley and Castán-Broto, 2012; Rose and Ståhlberg, 2005). A second phenomenon is a general trend towards decentralisation of authority in Europe[37] – in particular in Scandinavia – providing local institutions with increasing responsibilities, expanding participatory rights, while enhancing public accountability (Wollmann, 2004). Past reforms altered local authorities' roles and responsibilities (Lidström, 2011). In the process they facilitated a more strategic governing role, preparing local authorities to learn to adapt to coming challenges, including climate change.

Senge (1990) refers to organisations where new ideas are encouraged to develop, where employees and the whole organisation are continually learning, as learning organisations. Learning organisations are assumed to be better able to address complex challenges with high uncertainty, especially situations where adaptive capacity and flexibility are required to turn incoming information into appropriate strategies. Learning organisations and organisational learning received significant

36 In Scandinavia, public participation and information access were equally important for NPM (Lidström, 2011; Wollman, 2004).

37 Not all European countries subscribe to decentralisation; the UK remains primarily centralised with nominal localism.

attention in the 1990s, notably in literature on management and organisation (Örtenblad, 2002; Rowley and Gibbs, 2008; Yeo 2005). Debates on the wider applicability of these concepts are ongoing, also with regard to local authorities and environmental governance (Dieleman, 2013; Hartley and Allison, 2002; Siebenhüner, 2008; Siebenhüner and Arnold, 2007). The difference between learning organisations and organisational learning is most commonly referred to as the former being an end, the latter being a means (Armstrong and Foley, 2003). Learning organisation literature focuses on identifying characteristics that facilitate an organisation to learn, thus serving as an organisational form. Scholars who address organisational (and social) learning examine how learning develops within an organisation (Hinkel *et al.,* 2010; Tàbara *et al.,* 2010). They pay attention to the learning process (Folke *et al.,* 2005; Gerger-Swartling, 2009; Nilsson and Örtenblad, 2002; Yeo, 2005).

This paper focuses on learning organisations, using Senge's conceptualisation of learning organisations as its starting point. While originally applied to management and organisation studies, it is applicable to studies on public administration and elected officials (Senge, 1990). Despite criticism of Senge's demarcation of learning organisations (Örtenblad, 2002; Örtenblad 2007; Rowley and Gibbs, 2008) his work, *The Fifth Discipline*, is used as a starting point, since both academics and professionals most commonly refer to it when discussing learning organisations (Örtenblad, 2007; Yeo, 2005). Senge's approach provides a framework to examine urban climate governance factors, stressing learning within a local authority.

For Senge, there are five disciplines – or conditions (Örtenblad, 2002) – for creating a learning organisation: personal mastery, mental models, team learning, building a shared vision and systems thinking. The first four disciplines serve as antecedents of the fifth, systems thinking, demonstrating their interconnectedness. According to Senge (1990, p. 12) "the five disciplines develop as an ensemble." He identifies three levels of learning: individual, team and organisational (Senge, 1990; Yeo, 2005). We refer to these as the individual, internal and external dimensions of learning within the local authority. Concerning the individual dimension, personal mastery includes personal commitment to learning, notably among those in leadership. In urban climate governance literature, leadership is equally stressed (Bulkeley, 2010; Kingdon, 1995; McCormick *et al.,* 2013). Concerning the internal dimensions (within an organisation), mental models establish beliefs and principles, which grant meaning; team learning includes dialogue, training and goal setting. In urban climate governance internal communication and organisational capacity are emphasised (Klein and Huq *et al.,* 2007; Rogers, 2009). Concerning the external dimension, when individuals and organisations build a shared vision, they become aware of expectations and find direction. Finally, systems thinking enables persons and organisations to

examine a problem in its full setting. In our case this refers to how a local authority functions within a multi-actor and multilevel system. In urban climate governance, scholars emphasise communication and participation with citizens and stakeholders, as well as horizontal and vertical collaborations with other cities and government levels (Bulkeley and Castán-Broto, 2012; Kern and Bulkeley, 2009). When learning occurs at all levels, or dimensions, this is referred to as systemic learning, which is what an organisation should strive for (Yeo, 2005). Senge's conceptualisation, while not an exact fit, aligns with relevant factors in urban climate governance literature (Bulkeley, 2010; Burch, 2010; Dieleman, 2013; McCormick *et al.,* 2013; Rogers, 2009; Shaw and Theobald, 2011).

Using Senge's conceptualisation of learning organisations, a framework can be developed to examine whether a local authority has the characteristics to embrace and institutionalise learning in its ability to confront climate change. This framework helps to understand (and define) a local authority as a learning organisation in climate governance (see Table 3-1). In this framework, learning organisation disciplines are referred one-to-one to urban climate governance factors. However, disciplines and factors are interdependent and overlapping. For example, a learning organisation's team learning most obviously correlates to urban climate governance's emphasis on building organisational capacity. Team learning is also dependent on leadership, dialogue and communication. Effective urban climate strategy is not the result of a single urban climate governance factor, just as a learning organisation is not the result of a single discipline; rather the interdependent combination of disciplines/ factors facilitate effective urban climate strategy. The remainder of this section frames urban climate governance literature from a learning organisation perspective.

3.2.1 Individual Dimension – Leaders with Personal Mastery

Learning organisations start with personal mastery, including personal goals and commitment to learning (Senge, 1990). This requires a new form of leadership, centred on vision. "In a learning organisation, leaders are designers, stewards and teachers. They are responsible for building organisations where people continually expand their capabilities to understand complexity, clarify vision and improve shared mental models – that is, they are responsible for learning" (Senge, 1990, p. 340). Urban climate governance also requires leaders who motivate employees, recognise opportunities, identify and transform barriers and make use of existing powers; who think beyond election cycles, focussing on long-term planning (Folke *et al.,* 2005; Shaw and Theobald, 2011). Siebenhüner and Arnold (2007, p. 343) identify leaders who "initiate innovations and keep innovation processes in motion". Such persons are often called policy entrepreneurs (Kingdon, 1995; Bulkeley, 2010). Leaders (e.g. mayors, senior staff) who understand the relevance of adopting urban climate

strategies and embracing sustainable development – and how these can increase a city's overall attractiveness and competitiveness – are more likely to include climate change amongst policy priorities, especially when deciding how to use scarce financial and human resources (Burch, 2010; McCormick *et al.,* 2013; Rogers, 2009; UN-Habitat, 2011).

3.2.2 Internal Dimension – Dialogue and Communication to Develop Shared Mental Models

Mental models include beliefs and principles that explain a cause-effect relationship, granting meaning to a particular issue (Bui and Baruch, 2010). This requires dialogue and communication inside an organisation, including how a message is framed or perceived, which influences beliefs, values, incentives and action (Tàbara *et al.,* 2010). In contrast, ineffective communication can jeopardise a learning organisation's shared vision (Bui and Baruch, 2010). Dialogue and communication strategies may reveal competing priorities or discourses, such as framing mitigation and adaptation as competing or complimentary (Bulkeley and Castán-Broto, 2012; Nilsson and Gerger-Swartling, 2009). Ideally, via dialogue, issues are continuously reframed until consensus is reached. This is particularly relevant regarding complex and dynamic challenges like climate change, as learning to adapt to a changing system requires continuous dialogue to revitalise a mental model, enable comprehension and build trust, while acknowledging different perspectives can coexist. In some contexts, climate change itself becomes contested and its problem definition politicised, stalemating any strategy, shared mental models and organisational learning (McCright and Dunlap, 2011).

Learning organisation and urban climate governance research indicate that organisational cultures built on trust, respect and low-power distances (e.g. junior and senior staff speak freely and share responsibility) is more likely to generate a sense of community, encourage dialogue and facilitate continuous learning (Folke *et al.,* 2005; Gephart *et al.,* 1996; Rogers, 2009). Within the local authority, dialogue across departmental silos and with stakeholders can reinforce a particular mental model, preventing strategies from undermining each other (Wilbanks and Sathaye, 2007; Nilsson and Gerger-Swartling, 2009). How climate change is communicated to society influences subsequent responses, especially if climate scepticism is relevant. Perceived vulnerability, community values, the level of societal empowerment and trust in (local) government, influence if, when and how cities act (Burch, 2010; Carter, 2011; Folke *et al.,* 2005; Glaas *et al.,* 2010).

3.2.3 Internal Dimension – Enhancing Capacity via Team Learning

According to Senge (1990, p. 14) "the basic meaning of a 'learning organisation' is an organisation that is continually expanding its capacity to create its future." A learning

organisation's culture encourages experimentation and risk-taking, with mistakes viewed as opportunities for organisational learning (Gephart *et al.,* 1996). A focus on long-term sustainable development can reinforce adaptive capacity, strengthening a city's response to climate change and improving resilience (Martens *et al.,* 2009). Alavi and McCormick (2004) argue less hierarchical organisations tend to be more willing to work together towards a common goal, especially if they incorporate a future-oriented perspective. Committed employees, willing to acquire new skills, can expand organisational capacity (Senge, 1990). Learning organisation and urban climate governance research identify the need for broad-based (e.g. city as a whole) and specific capacities (e.g. technical expertise) within an organisation (Bui and Baruch, 2010; Klein and Huq *et al.,* 2007). Capacity can be extended via interactive team learning, trainings or workshops, as well as providing spaces for interaction (Hinkel *et al.,* 2010). Such activities, however, require resources, including financial support, staff time and expertise (Rogers, 2009, Wilbanks and Sathaye, 2007).

3.2.4 External Dimension – Communication and Participation to Build a Shared Vision

Building a shared vision, one that the local authority and relevant stakeholders (e.g. civil society, private sector) contribute to, can result in more authentic climate policy; moreover, successful implementation will depend on stakeholder support (Klein and Huq *et al.,* 2007). To do so requires effective external *communication*: to generate curiosity and comprehension amongst stakeholders, and *participation*: to generate stakeholder engagement. When constructing a shared vision: participants understand what is expected, become part of a process and embrace ownership (Fünfgeld, 2010; Senge, 1990). Participation implies continuous learning; an organisation must learn to balance competing demands and discourses, whilst maintaining accountability and legitimacy (Bulkeley and Castán-Broto, 2012). Doing so effectively can increase trust in local government organisations.

Active participation ensures that local expertise is not overlooked, but reinforces scientific knowledge (McEvoy *et al.,* 2010). It can tap the skills and interests of the private sector and the public, offering creative approaches to common challenges, while building policy support. To facilitate participation requires some informality, flexibility and an emphasis on learning-by-doing, to balance competing demands (Folke *et al.,* 2005; Glaas *et al.,* 2010; Rogers, 2009). Organisations embedded in cultures of trust, with high societal collectivism, social capital, and those who use horizontal dialogue to communicate across organisations and with stakeholders are more likely to work together towards a common goal (Alavi and McCormick, 2006; Folke *et al.,* 2005).

Table 3-1 Local Authorities as Learning Organisations for Urban Climate Policy

Dimensions	Learning organisation disciplines
Individual dimension (e.g. politicians, directors and managers)	*Personal mastery* Personal goals, commitment and vision, centred on learning Foster engagement and commitment of others Leaders as designers, stewards and teachers; responsible for learning
Internal dimension (e.g. department level and the interactions between departments)	*Mental models* Beliefs, ideas and principles which grant meaning and build comprehension Moderated by dialogue, communication and message framing Moderated by organisational culture (e.g. trust, low-power distances, leadership and commitment)
	Team learning Capacity generated from within: dialogue, communication and commitment Experimentation, risk-taking and innovation encouraged Interactive team learning (e.g. training) A supportive organisational culture and work environment (e.g. future-orientated)
External dimension (e.g. how the organisation relates to others)	*Building shared visions* Individual visions are shared, to build a common (shared) vision which all relevant parties subscribe to A clear direction of what is expected and how to get there High societal collectivism, openness, trust and social capital are beneficial to develop flexible and creative approaches
	Systems thinking Built on preceding disciples, combined Capacity of individuals and a system to examine the problem in its full context (e.g. internally and with external relations) Continuous learning, emphasizing dialogue amongst partners in a collective effort

Urban climate governance factors
Leadership Policy entrepreneurs with internal vision Key persons, serving in strategic positions with the ability to initiative innovation and keep it in motion Ambitious use of existing powers and recognizing opportunities An emphasis on long-term planning
Internal Communication Message framing (e.g. challenge or opportunity; competing or complementary priorities; issue complexities) Communication and dialogue within and across departmental silos (sectors) A level of trust to speak freely
Capacity A dialogue-rich atmosphere Committed employees who share a vision and explore innovative ways to get there Resources (e.g. time, staff, expertise, skills and training, financial assets)
Communication and Participation Foster comprehension and ownership of city's climate vision amongst stakeholders Citizens know where to go and feel empowered to participate A degree of informality and flexibility (e.g. learning-by-doing) Creative approaches engage citizens, NGOs and the private sector
Vertical and horizontal collaborations Multi-level system of interactions amongst the local authority and its partners (e.g. higher levels of governments, city-to-city networks, collaboration in the metro-region) Multi-actor partnerships: private-sector actors and scientific collaborations to build further expertise and access funding

3.2.5 External Dimension – Vertical and Horizontal Collaboration to Enhance System Thinking

For Senge (1990) the preceding four disciplines are antecedents of the fifth, systems thinking – together building a stronger organisation internally and externally. Systems thinking facilitates comprehension of how an organisation – a local authority – interacts with external actors, how internal decisions shape outside organisations and vice versa (da Silva *et al.,* 2012; Fullan, 2004). In urban climate governance, a city does not operate in a policy vacuum, but within a multilevel system, including vertical (e.g. higher government) and horizontal (e.g. city networks, neighbouring cities) interactions, which influence a city's ability to incorporate and institutionalise climate policies (Bouteligier, 2012; Bulkeley, 2010; Burch, 2010). Given the complexity of climate change, vertical support (e.g. legal frameworks, financial subsidies) and external expertise (e.g. higher government, scientific institutions) can enable urban climate policies (McCormick *et al.,* 2013; UN-Habitat, 2011). Horizontally, dialogue and collaboration within city networks and with neighbouring municipalities can avoid spatial mismatches, while these stakeholders learn to share resources (Kern and Alber, 2008). Nevertheless, local authorities should caution against relying too extensively on external resources, as political parties or the prioritisation of political agenda items – and (financial) support – may shift, in particular during periods of austerity (den Exter *et al.,* 2014).

3.3 Malmö as a Learning Organisation in Addressing Climate Change

This section explores to what extent Malmö's local authority emphasises learning and dialogue when enacting urban climate strategies, and if it acts as a learning organisation.

At the national level, Sweden is considered to have one of the strongest local authority forms in Europe, politically and functionally, including the power to levy income taxes (Lidström, 2011; Wollmann, 2004). Highly decentralised, local authorities are responsible for the majority of public services and goods (e.g. education, planning, environmental protection, social services). Via the *Local Government Act of 1991*, local authorities have the autonomy to develop an organisational structure best suited to fulfil these duties (Lidström, 2011; Wollmann, 2004). Regarding mitigation, Sweden is considered a forerunner; it placed highest in the *2012 Climate Change Performance Index* due to low emission levels and downward trends, notably in the housing sector (Burck *et al.,* 2011). Regarding adaptation, Sweden adopted a *National Adaptation Strategy* in 2009, including climate change scenarios (e.g. wetter winters, drier

summers, changes in the Baltic Sea and impacts on natural, social and technical systems) and a focus on local adaptation (EEA, 2012). Sweden was also an early adopter of *Local Agenda 21* and has traditionally demonstrated strong commitment to local climate action, including national policy guidance and financial subsides (Eckerberg and Forsberg, 1998; Smedby and Neij, 2013).

At the local level, Malmö is the capital of Sweden's southernmost province, Skåne, with a population of 300,000 (see Figure 3-1). Historically an industrial city, Malmö was home to Kockums Shipyard. This changed in the 1980s/1990s, when Malmö's industries collapsed. Despite challenges, this presented city leaders an opportunity to redirect Malmö's identity. Three decisions initiated Malmö's transition: the construction of *Malmö University*, the construction of the Öresund Bridge between Malmö and Copenhagen, and the construction of *Bo01* – Sweden's first 100% renewable energy city-district in its Western Harbour which addressees mitigation and adaptation by design (e.g. energy efficiency, renewable energy, open storm-water management, green roofs). For over 15 years, Malmö has addressed sustainable development and climate change via technical measures (e.g. food waste and sewage sludge transformed to biogas), institutional measures (e.g. local laws, communication, participation) and large-scale pilot projects (e.g. Bo01). While mitigation is prioritised, as a low-lying coastal city, Malmö is vulnerable to climate change (e.g. sea-level rise, rising temperatures, sporadic flooding or drought) (City of Malmö, 2012). Current policies attempt to integrate mitigation and adaptation within a sustainable development perspective.

GHG emissions are monitored in several ways: nationally, emissions are measured annually, including statistics per municipality; locally, Malmö conducts traffic splits on automobile numbers and monitors particulate matter. Information is publicly available on the local authority's website. Statistics confirm Malmö's GHG emissions fell from 1460 thousand-tonnes in 1990 to 1350 thousand-tonnes in 2008, despite a population and GDP increase (City of Malmö, 2013). However, in 2010 E-ON opened Öresundsverket, a natural gas combined-heat-and-power (CHP) plant supplying 3 TWh of electricity and 1 TWh of heat. Malmö's GHG emissions increased to 2490 thousand tonnes – rising 84% between 2008 and 2010 – demonstrating efforts to address climate change must emphasise collaboration with actors beyond municipal control, such as private energy companies.

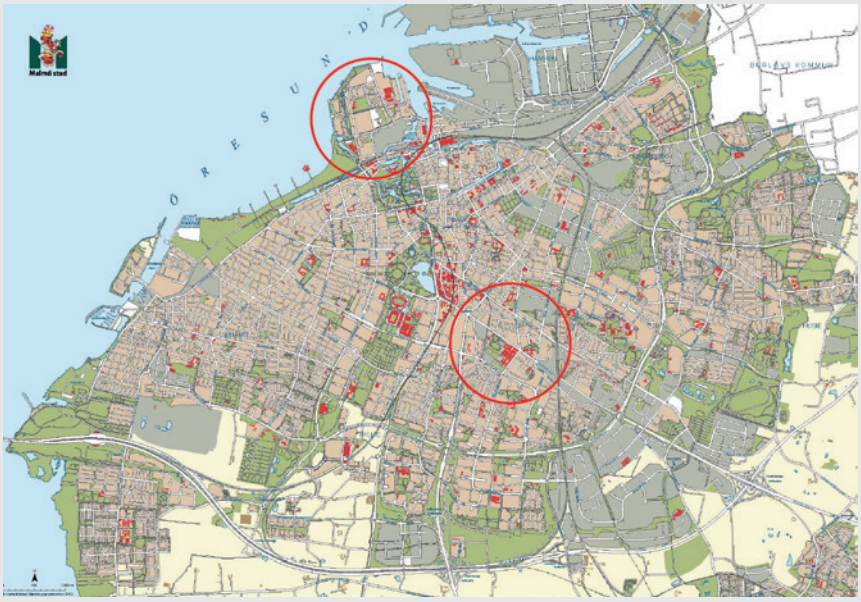

Figure 3-1 Map of Malmö indicating the Western Harbour and Augustenborg neighbourhoods[38]

Still, Malmö's local authority is often cited as a forerunner in urban sustainability and climate policy (e.g. 2010 *World Habitat Award,* 2009 UN-Habitat *Scroll of Honour*) and receives 5000 expert visitors[39] a year. Despite its environmental reputation, Malmö suffers from crime and segregation, notably in its immigrant-dominated neighbourhoods. According to interviewees, Malmö depicts a split image: city of sustainability, of culture, the regional growth hub – and of crime scenes and income disparity. Its greatest challenge is learning to connect these issues.

Malmö decided not to enact a specific climate policy. Instead mitigation and adaptation are integrated in various policies to ensure climate targets are addressed across sectors and departments (Dowding-Smith, 2013). Strategically climate change is addressed in the *Environmental Programme* (2009) and the *Master Plan* (2011). Malmö's Environmental Programme has the objective that Malmö will become "Sweden's Most Climate Friendly City" (e.g. by 2020 all public buildings and

38 Sourced with permission from the City of Malmö

39 Expert visitors include urban planners, politicians, academics, city network representatives and business partners.

procurement will incorporate renewable energy and energy efficiency; by 2030 the entire municipality will run 100% on renewable energy). Malmö's Master Plan (2012-2032) has the long-term objective that Malmö will become "a sustainable and attractive city". Neither document is legally binding. Still according to interviewees, adherence is high: circa 95% of city projects fulfil stated criteria. As adaptation is a newer policy area, Malmö also has an *Action Plan for Adaptation* which includes an emphasis on "climate-adapted planning" with references to several EU-sponsored projects[40] on adaptation experiments in Malmö. Operationally, climate change is addressed in several documents: on energy and buildings (e.g. *Energy Strategy, Environmental Building Programme for Southern Sweden*), on transportation (e.g. *Traffic Environment Programme, Bicycle Programme, Walking Programme*), on green/blue spaces (e.g. *Green Plan, Nature Protection Plan* and *Rainwater Strategy*) and on consumption (e.g. *Policy for Sustainable Development and Food*).

Climate strategies are predominantly coordinated by the Environmental Department, but other municipal departments and regional authorities are involved, including the City Hall, the Streets and Parks Department (addressing transport infrastructure and green spaces), the City Planning Office, the Real Estate Office (addressing public land sales/ leasing), the Internal Services Department (managing public infrastructure) and *VA Syd* (municipal water company). Transportation and waste management are addressed regionally: *Skånetrafiken* is responsible for public transport; *SYSAV*[41] is responsible for waste management.

As the largest land owner, building manager and employer, Malmö has considerable influence over GHG emissions in its jurisdiction. Firstly, Malmö has a planning monopoly; the City Planning Office must approve all new projects. Secondly, all municipal buildings run on "green certified electricity". Thirdly, Malmö has influence over private developments, notably those built on municipal land. Following economic collapse, Malmö was forced to purchase the Western Harbour from the retreating industries (e.g. Kockums, Saab). As the primary landowner, before contracts are signed and land sold, developers must agree to stricter requirements than national building standards, as specified in the *Environmental Building Programme for Southern Sweden*. New techniques, such as passive housing, green roofs or small-scale renewable energy instillations, are tested in Western Harbour and then applied to other parts of Malmö – with less hesitation from private developers who learned to incorporate these techniques in Western Harbour. The Building

40 Includes: *Green-Clime-Adapt*, sponsored by EU LIFE+ and *Green and Blue Space Adaptation for Urban Areas*, sponsored by EU Interreg IVA

41 SYSAV is a publically owned company, jointly owned by several municipalities in Skåne.

Programme[42] is now required in all new developments which rent or purchase municipal land.

3.3.1 Individual Dimension – Leaders with Personal Mastery

Malmö's climate polices are influenced by local politicians, directors and managers who demonstrate commitment to climate leadership (Norrman, 2010; Dowding-Smith, 2013). According to interviewees and proven by awards (e.g. *2012 Lee Kuan Yew World City Prize*) former Mayor Ilmar Reepalu (in office 1994- 2013) was a driving force behind Malmö's forerunner status in urban climate governance, demonstrating a high level of personal mastery. Taking office at the height of Malmö's economic crisis, Reepalu saw this as an opportunity: Malmö was in need of a new identity. Mayor Reepalu came to office with an economic vision, a youth vision, a social vision and a city planning vision – a long-term plan to move Malmö from its industrial past towards a sustainable future. Malmö's own policy entrepreneur, Mayor Reepalu proclaimed "Malmö's story of transition" at conferences, among business partners and investors, and among employees and citizens; together constructing Malmö's shared vision. Interviewees stated this stable leadership and vision have influenced Malmö's climate strategies.[43]

Leadership is also emphasised amongst department directors and sub-managers, who encourage innovative thinking and cross-sectoral collaboration. They encourage civil servants and technical experts to develop their own personal mastery, taking responsibility and engaging in inter-departmental issue committees.

3.3.2 Internal Dimension – Dialogue and Communication to Develop Shared Mental Models

According to interviewees and conference documents, Malmö embeds climate policy and green growth within its broader sustainability strategies, developing a particular mental model. These issues are framed as relevant not only for the environment, but also socioeconomic concerns. To enhance understanding and approval of climate strategies, routine meetings amongst departmental directors, local politicians and civil servants are organised, resulting in a shared and repeated mental model: "the Malmö story of transition." Having everyone – at all levels of the organisation – reiterate the same story reduces miscommunications and conflicts and increases organisational trust, according to interviewees. Moreover, climate

42 National government was in the process of debating whether local governments have legal footing to set standards higher than national government during the time of writing this chapter.

43 Mayor Reepalu's leadership faced controversy in other areas concerning his reactions to property vandalism against a Malmö minority group (Stevens, 2010). While statements were clarified, this tainted his reputation. Reepalu stood down in 2013.

scepticism is low in Malmö; notably, the Environmental Programme was adopted unanimously across party lines (Dowding-Smith, 2013). Still, building a coherent understanding of Malmö's climate policy – even within the local authority – has proven a long process. A socially segregated city, Malmö has the highest crime rate in Sweden. Not all departments or politicians agree climate change should feature as top priority. This occasionally places social and technical departments at odds as to whether social equity and security, or infrastructure and environment, should be prioritised. Such challenges influence Malmö's dominant mental model, and how it is framed and communicated. Malmö's Environment Department encourages creating a more visible link between environmental and social concerns, framed as environmental justice.

3.3.3 Internal Dimension – Enhancing Capacity via Team Learning

Malmö's economic crisis of the 1990s initiated a process of continuous capacity development. It forced Malmö to learn to function as a singular unit, across departments and hierarchies, adopting attributes of team learning. Over time this generated organisational capacity within the local authority, including technical know-how, collaboration methods and the breakdown of sectoral approaches via regular cross-departmental workshops and meetings, especially among technical departments. Building on successes and failures, Malmö is not afraid to experiment with new policy or technical approaches; there are no mistakes, only learning processes (Norrman 2010). Malmö perceives sustainability as a continuous learning process, referred to as an on-going journey[44].

Malmö has circa 50 employees engaged in climate and sustainability strategies. Thirty work at the Environment Department; others are integrated within the City Planning Office, Streets and Parks Department, Internal Services Department and Real Estate Office. Themes, like transport, have coordination teams which meet monthly; this facilitates policy integration across departmental silos to combine expertise and develop integrated strategies. Meetings are often held in Malmö's inter-departmental sustainability centre, *Helix,* a physical space to foster collaboration, enrich team learning and build local capacity. Dedicating sufficient resources and high staff numbers in the local authority is a strategic decision; it allows employees time to explore innovative policy or planning approaches. Malmö also brands itself as a climate forerunner: nationally, within Europe and in city network affiliations. This has positive economic consequences: for example, the Danish wind energy company *Vestas* relocated its Nordic headquarters to Malmö. Malmö also placed fourth in

44 This conversation was held amongst Malmö politicians and conference delegates attending COP15 in Copenhagen, December 2009.The lead author attended this meeting.

Forbes "World's 15 most inventive cities" for 2013, noting efforts in the clean-tech sector.

3.3.4 External Dimension – Communication and Participation to Build a Shared Vision

While Malmö emphasises structured internal communication, stakeholder engagement is less formalised. Instead a learn-by-doing approach encourages flexible participation of NGOs, citizens and businesses. Although flexible, communication and participation are emphasised in the Environmental Programme to build a shared vision together.

Concerning communication, Malmö offers study tours for visiting urban experts in its "climate arenas" (e.g. Augustenborg Botanical Roof Garden or Bo01). From 2006-2011, Malmö has hosted the *No Ridiculous Car Journeys Campaign* every May, during which civil servants in orange jumpsuits rode on blue bicycles to promote city cycling[45] as an alternative to cars for short distances. Public concerts in city squares highlight cycling, and citizens can compete to be the "most ridiculous car driver." This cycling campaign is highly visible: when polled 50% of residents acknowledge awareness of the campaign; 15% state it has altered their driving habits (City of Malmö, 2010a)[46]. Via such strategies, planners estimate that 35% of commuting to work and school is done by bicycle; meanwhile car journeys fell from 52% in 2003 to 41% in 2008 (City of Malmö, 2009b). Still for 10 years, total car numbers remain constant, due to a rising population and regional commuting, indicating Malmö will have to work closer with neighbouring municipalities and improved public transport options to lower car numbers.[47] Current transport emissions from commuting are circa 500,000 tons of CO2-equivelent per year (Malmö 2009b).[48]

Concerning sustainability education, several programmes receive funding and political support. Since 2001, Malmö's local authority offers *Climate-X,* interactive workshops for secondary students on climate change. Since 2010, Malmö collaborates with Copenhagen and Lund in a EU-sponsored education partnership, Öresunds-*klassrummet,* which "engages students and teachers in envisioning new learning processes for a sustainable society". Additionally, by 2020 all schools, healthcare

45 The campaign targeted those driving five kilometres or less, referred to as "ridiculous driving".

46 The campaign was replicated in Helsingborg, Kristianstad and Umeå (City of Malmö, 2010a).

47 Circa 10% of Malmö residents commute (e.g. to Lund and Copenhagen) for work, with circa 20% of Malmö employees commuting in from neighbouring municipalities (Öresunddirekt, 2013).

48 This does not include the Copenhagen-Malmö Port (CMP). As a bi-national port, Malmö does not have regulatory authority over CMP, which adheres to national/ EU legislation on port emissions (e.g. sulphur). Port industries are part of a EU-sponsored project (*E-harbours*) to encourage electricity use in industrial vehicles and energy exchange via industrial symbiosis.

and public catering will serve organic or ethically certified meals[49]. Several schools have done so already, remaining within the same budget, often via reduced meat consumption. These methods were shared with Malmö School Restaurant staff during a series of workshops in 2011, and teachers educate students on the link between food consumption and climate change.

Concerning participation, Malmö realises it will not meet its climate targets without engaging citizens and the private sector. Regarding more vulnerable citizens, Malmö attempts to combine social inclusion and environmental sustainability, focussing on specific neighbourhoods. Its largest efforts are in Augustenborg and Rosengård. Built in the 1950s and 1960s respectively, these neighbourhoods suffer(ed) from flooding and poor insulation as well as crime and unemployment. Both are predominately immigrant communities, so participation techniques vary to engage diverse populations, while focussing on target groups (e.g. youth, elderly, community leaders, women). *Ecocity Augustenborg* began in 1998 to address seasonal flooding (via green roofs and open storm-water management) and energy concerns (insulating 1,800 apartments, incorporation of solar panels). Simultaneous to physical measures, citizen participation was stressed from the beginning (via information sessions, workshops, festivals and cultural events) to encourage project ownership, clarify expectations of the local authority and residents, and to facilitate project legitimacy. Roughly 20% of residents participated and many projects were resident-initiatives, such as the open storm-water management system, a community carpool and *Café Sommar* (café/community space).[50]

Building on the lessons of Augustenborg, in 2008 Malmö (with a public housing company) initiated similar plans for Rosengård, including: better connectivity to central Malmö (e.g. improved cycling lanes, more buses), renewable energy (e.g. urban windmills, solar panels at the school) and improved social spaces (e.g. a climate-smart food centre, community gardens, a women's activity centre). In Rosengård, Malmö combines innovative environmental technology, planning and increased social and economic integration, working with residents to do so.

Concerning resident initiatives, the Environment Department offers grants (circa 1.3 million SEK/year) for community start-ups. Previously undersubscribed, many high quality applications now compete. In addition to official grants, municipal budget flexibility is encouraged. Malmö's Head of Sustainable Communities at the Environment

49 Specified in *Malmö's Policy for Sustainable Development and Food* (2010).

50 Ecocity Augustenborg had other spin-off effects. Interviewees highlight an increased level of trust in (local) public decision-making. Participation in local elections also increased from 54% in 1998 to 79% in 2002 (World Habitat Award, 2010).

Department stated, “When it comes to community organisations, they come with passion and excitement to start something now... If we are going to be an active support mechanism, we need flexibility.” One start-up, *Children in the City*, linked elderly residents with immigrant families in socially deprived areas via arts and urban agriculture. This evolved into a non-profit, *Grow in the City*, which Malmö hired to develop community gardens in Rosengård.

Concerning public-private partnerships, Malmö participated *in Sweden’s Building-Living-Dialogue*, a collaborative planning method to engage architects, developers and civil servants in partnership throughout the building process, combining expertise on specific themes, such as energy, safety and green space (Smedby and Neij, 2013). This collaboration reduced production costs (e.g. building a joint-parking garage, shared landscaping) while addressing mitigation and adaptation (e.g. passive-energy housing, green space planning) and other sustainability concerns (e.g. health, safety). Malmö also provides physical spaces to encourage interaction and innovation: *Minc* is an incubator and workspace for sustainability entrepreneurs, venture capitalists and academics.

Still, Malmö’s climate ambitions remain strongly influenced by its largest stakeholders, notably its energy companies. The 2009 opening of E-ON’s natural gas CHP plant, Öresundsverket, drastically increased Malmö’s per capita GHG emissions. As energy security is of national interest (*riksintresse*) however, Malmö does not have the authority to obligate renewable energy, for example converting Öresundsverket to biogas production. Still, according to an interviewee, through continued dialogue between Malmö and E-ON, E-ON is beginning to consider a transformation to biogas. This however is a slow process: in 2008, E-ON had no interest in biogas; by 2010 they started “speaking” about biogas as a substitute for natural gas. No timeline is established. In other projects, E-ON is more cooperative. In Malmö’s new Hyllie neighbourhood, Malmö, VA Syd and E-ON signed a *climate contract* on renewable energy and energy efficiency. According the same interviewee, “E-ON sees Malmö as a testing ground for new innovations, which can be used for marketing/profiling.” E-ON and Malmö are also piloting smart grids in several neighbourhoods.

Dialogue and collaboration with Malmö’s largest stakeholders, and its more vulnerable residents, remains a dual priority to further Malmö’s climate strategies.

3.3.5 External Dimension – Vertical and Horizontal Collaboration to Enhance System Thinking

While Malmö has significant autonomy in arranging its climate policy, it functions in a broader system, including vertical and horizontal interactions, influencing its climate

strategy goals. A systems thinking perspective helps Malmö recognise external interactions with multiple actors at multiple levels, and make use of them in advancing climate learning and leadership.

Vertically, Malmö collaborates with national agencies, such as the Energy Agency (*Energimyndigheten*), the Environmental Protection Agency (*Naturvårdsverket*) and the National Board of Housing, Building and Planning (*Boverket*). The EPA's Climate Investment Programme (KLIMP) and its predecessor Local Investment Programme (LIP) funded numerous climate projects in Malmö, providing grants for hard and soft measures. KLIMP concluded in 2012; but other agencies continue to offer financial support. The Energy Agency runs a programme called *Sustainable Municipalities* and the Housing Board finances one-third of project costs via a programme called *Delegation for Sustainable Cities*. In 2011, Malmö received one billion SEK (114-million) from the Delegation to retrofit Rosengård on energy efficiency, transportation, climate-smart food and participation strategies for hard to reach groups. Still, most subsidies terminated at the end of 2013, with no new subsidy schemes yet established. At the EU level, Malmö has a permanent representative in Brussels to follow, influence and learn about new legislation and funding opportunities. Many departments have an EU coordinator. Consequently, Malmö's is involved in multiple EU-sponsored projects[51] that encourage learning and interaction among partner cities and within the local authority, further engraining climate strategies. Malmö joined the EU Covenant of Mayors in 2008 and former Mayor Reepalu chaired the EU Committee of Regions' Commission for Environment, Energy and Climate Change.

Horizontally, Malmö works with city networks and regional partners. Network participation includes: ICLEI, Eurocities (Reepalu chaired the Environment Forum), Baltic Metropoles, Energy Cities, Union of the Baltic Cities, and Similar Cities. Nationally, Malmö is involved with *Klimatkommunerna* and collaborates with Sweden's largest cities, Stockholm and Göteborg. Reepalu also served as president and vice president of Swedish Association of Local Authorities and Regions.

Regionally, Malmö engages with neighbouring municipalities and sectoral authorities in Skåne, depending on specific policy goals (e.g. energy, transport, climate adaptation). Malmö participates in *Energy Öresund* – a collaboration of Swedish and Danish municipalities and energy companies to become "the first carbon-neutral region in Europe". Collaboration with Lund and Copenhagen is high on the political

51 EU-financed support schemes include, but are not limited to: CIVITAS (*Sustainable Mobility for people in urban areas*), LIFE+ (*Plug-in-city Malmö* and *Climate Living in Cities Concept*), Interreg IVA programme (Öresundsklassrummet) and IEE (*Partnership Energy Planning as a tool for realising European Sustainable Energy Communities*).

agenda, including research/business links and improved public transportation, as well as a high-speed cycle way between Malmö and Lund. With Vellinge and Flasterbo municipalities (south of Malmö) a new offshore wind-park and a light-rail link are being discussed. Still, interviewees indicate few concrete steps have been taken, in part because Malmö does not have autonomy outside its own jurisdiction. Climate adaptation presents a new avenue for cooperation with neighbouring local authorities; currently Malmö discusses storm-water management and flooding concerns with neighbouring municipalities.

3.4 Discussion and Conclusion

This paper examined how local authorities, as learning organisations, address climate change. Due to the multiple complexities and uncertainties of climate change, when local authorities develop and implement (long-term) urban climate strategies, these strategies should be adaptive and flexible. Local authorities need to adopt an institutionalised ability to continuously learn to adapt their strategies, thus becoming learning organisations. To examine what it means for a local authority to become a learning organisation in urban climate governance, we examined one of the 'best practitioners' until now: Malmö, Sweden.

Malmö's local authority appears to have adopted various characteristics of a learning organisation, in its organisational structure and working methods when addressing climate change. Its climate priorities are embedded in top steering documents and its vision to become an "environmentally, socially and economically sustainable city". Climate change is the challenge; the solution is a continued focus on sustainable development and learning. Malmö could have followed a very different trajectory after its economic crisis of the 1980s/1990s. Instead, leadership, a shared, internalised and consistently disseminated sustainability vision, and an organisational structure centred on learning, drove climate policy ambitions and implementation forward. Although the former mayor was criticised in some areas, his environmental leadership offers a lasting legacy. Likewise, priorities on dialogue, communication and partnerships (internally and externally) enhance Malmö's learning capacity, and encourage citizens and private actors to participate in co-developing and co-implementing a common climate vision. Malmö takes advantage of vertical and horizontal collaborations to facilitate its climate policies, such as national/EU support, engaging in city networks and with regional partners. Learning Organisation Theory and urban climate governance factors are evident in Malmö, albeit some factors having greater relevance than others. It is the interdependence of many factors (rather than one single factor) that is responsible for Malmö's successful, and in many regards, its

forerunning position in urban climate governance. This resembles the ideas of interdependent disciplines within Learning Organisation Theory.

But challenges remain for Malmö's local authority. Firstly, several individuals, notably Malmö's longstanding mayor, are accredited as drivers behind its success. Will Malmö maintain its position as an innovative forerunner, now that Mayor Reepalu has stepped down? Theoretically, learning, dialogue and partnership should have institutionalised innovativeness and flexibility, supporting adaptive climate strategies within Malmö's political and organisational structure, making it less vulnerable to personnel/leadership change; but time will tell. Secondly, with the opening of a natural gas CHP plant in 2009, Malmö saw its GHG emissions increase for the first time in a decade. Malmö's ability to reduce its emissions is largely dependent on the energy plant owner E-ON, challenging Malmö's authority and agency to address climate change. With E-ON's climate choices largely out of municipal control, achieving Malmö's climate strategy goals will require continuous dialogue and partnership with E-ON. Thirdly, Malmö has relied on national and EU financial support to facilitate many of its climate actions. However, key subsides (e.g. KLIMP) concluded in 2012 or 2013, while the European financial crisis may limit EU funding. Nevertheless, due to the decentralised nature of authority in Sweden, Malmö is largely responsible for climate-relevant sectors and strategies; however with fewer financial resources to do so. Malmö has to safeguard other funding sources or reduce its ambitions. Fourthly, while a climate frontrunner, Malmö is a divided city with enduring social challenges. Addressing social challenges remains a priority – although at times it competes with other priorities. Malmö's attempt to link social and climate challenges via an environmental justice perspective, is key to the enduring success of its climate governance model which focuses on dialogue, participation and shared visions.

Malmö, as a learning organisation, offers several lessons for other cities addressing urban climate governance. Firstly, deliberate and structured methods to facilitate "working across departmental silos" enable continuous dialogue and learning within the local authority, especially to balance different priorities and design innovative strategies. Secondly, strategic local politicians, who adopt and actively propagate long-term visions and recognise opportunities, leverage the implementation of urban climate strategies. Thirdly, using various (complementary) methods for dialogue and participation encourages stakeholder and citizen engagement. Stakeholders should be involved early to ensure ownership, in particular when the regulatory powers and resources of local authorities are limited. Continuous dialogue – within the organisation and with stakeholders – can institutionalise continuous learning and flexible working methods to adapt to coming challenges, including climate change.

4

New Roles for Local Authorities in a Time of Climate Change: the Rotterdam Energy Approach and Planning as a Case of Urban Symbiosis[52]



52 A version of this paper is in press, as: Lenhart, J., van Vliet, B., Mol, A.P.J., 2015. New roles for local authorities in a time of climate change: the Rotterdam Energy Approach and Planning as a case of urban symbiosis, *Journal of Cleaner Production*. doi:10.1016/j.jclepro.2015.05.026. (Images sourced from REAP.)

Abstract

As cities expand and environmental challenges multiply, linear relations between resource consumption and waste need to be broken, with outputs cycled back as inputs. Twenty years of industrial symbiosis research has provided ample evidence and experience how to close material and energy cycles in industrial systems. The more recent urban symbiosis literature develops a similar perspective and experience on closing waste-resource cycles for a different social system: cities. An urban symbiosis analysis on how to close urban waste-resource cycles has to focus on geographical boundaries, local partnerships, and policy interventions. In conducting a detailed case study of Rotterdam Energy Approach and Planning (REAP), this paper aims to identify how urban actors, notably local authorities, can facilitate improved urban resource management to mitigate climate change. REAP incorporates energy and water reuse in an urban area, using by-products as resources in different urban functions. It is coordinated by Rotterdam's local authority, in partnership with architects and academic institutions in its design, and housing corporations and energy companies in its implementation. The methodology to assess REAP includes a review of policy documents, site visits and in-depth interviews. This study revealed the central role of local authorities in governing urban symbiosis projects like REAP; the need for increased private-sector participation in the design stage of such projects; and the necessity to encourage dialogue, learning and flexibility in the governance of urban resource management.

4.1 Introduction

Humanity has become an urban species: over half of global population now lives in cities (UN-Habitat, 2011). This urban way of life however, has a price. Cities' metabolisms magnify resource consumption and waste production. The larger the city, the more it draws on nature's resources – locally and globally (Girardet, 2010; Hodson *et al.*, 2012). Concerning climate change alone, cities constitute between 40-70% of greenhouse gas (GHG) emissions requiring climate mitigation strategies (UN-Habitat, 2011). Cities also impact water, material, energy and nutrient cycles (Kennedy and Hoornweg, 2012). The consequences of climate change also impact urban infrastructure (e.g. water availability, energy spikes) requiring urban climate adaptation (and other) strategies that incorporate flexible planning (Fiksel, 2006; McCormick *et al.*, 2013).

Cities also offer opportunities to address environmental challenges. As geographically concentrated sites, cities are places where resource flows physically metabolise and can be measured; where interactions between networked infrastructure and natural environments occur and effective policies and planning approaches can be applied (Monstadt, 2009; Hodson *et al.*, 2012). Because of comparatively dense living arrangements and public infrastructure, urban residents' per-capita energy use is often lower than national averages in many industrialised and transitional countries (Dodman, 2009). Accordingly, cities are the loci and foci of technical, economic and social innovations not possible elsewhere (Hodson *et al.*, 2012; Hoornweg *et al.*, 2011; Monstadt, 2009).

Due to the concentration of environmental challenges (and opportunities) within cities, urban actors – notably local authorities – have a significant role in addressing them, in particular concerning climate change (UN-Habitat, 2011; Satterthwaite, 2014). In both scientific and policy debates, experts suggest that local authorities should play a more prominent role in (urban) climate governance (Bulkeley, 2010; Revi *et al.,* 2014; Seto *et al.,* 2014; UN-Habitat, 2011). Moreover, research has found that public-sector actors lead the vast number of urban environmental planning experiments, especially during initial phases (Bulkeley and Castán-Broto, 2012; Mees et al., 2012). However, local authorities' actions alone will not suffice due to the complex nature of modern environmental challenges; this requires collaboration between different actors at different scales (Bulkeley and Castán-Broto, 2012; McCormick *et al.*, 2013; Mees *et al.*, 2012; Ranhagen and Groth, 2012). Together they can design cities that not only promote resource efficiency, but cities that close resource-waste cycles (Girardet, 2010; Kennedy and Hoornweg, 2012; McCormick *et al.*, 2013) and facilitate integrated urban infrastructure solutions (Fiksel, 2006). As

cities improve their resource consumption efficiency, they reduce their GHG emissions and become more resilient to climate change disruptions (e.g. droughts or temperature surges which impact water and energy resources) (AMICA, 2007).

It is not only in cities where discussions to close resource-waste cycles have occurred. Since the 1990s, similar discussions have occurred in industry, where scholars called for the optimisation of industrial processes, using waste products as resources elsewhere (Frosch and Gallopoulos, 1989; Baas, 1998). In some cases this occurred automatically and made business sense; in other cases it was actively planned. In both cases industrial actors, in close geographic proximity, began to collaborate – known as industrial symbiosis (Chertow, 2007). Given an emphasis on urban resource consumption, van Berkel *et al.* (2009b) brought a distinctly urban dimension to industrial symbiosis – urban symbiosis[53]. Urban symbiosis examines material recycling in urban settings by analysing how urban resource exchanges (e.g. energy and water) could be better facilitated to close linear resource consumption in a city, and what the role(s) of local authorities, private actors, infrastructure providers and city-dwellers are in doing so.

This is vital given that according to Hodson *et al.* (2012, p. 790) modern urban infrastructure has been "designed, built, and operated in accordance with a particular set of technical modalities and governance routines that assumed a continuous supply of resources." As cities expand and resource consumption and waste escalate, sustainable urban futures will require more synergistic ways of closing resource-waste cycles (Hodson *et al.*, 2012; Ranhagen and Groth, 2012). This is even more relevant in light of complex (local-global) challenges, such as climate change. In Europe alone, 80% of energy consumption and CO2 emissions are associated with urban activity; European cities also house 75% of the European population (Covenant of Mayors, 2013). Moreover, dense urban environments offer substantial resource-saving potential (van den Dobbelsteen *et al.,* 2012) while serving as an appropriate platform to address climate change mitigation and adaptation (Revi *et al.,* 2014; Seto *et al.,* 2014). Consequently, any strategy to address resource consumption (and climate change) needs to include cities.

In light of the complex challenge of climate change that calls for local action, this paper aims to identify how urban actors, notably local authorities, could facilitate a more symbiotic approach to urban resource management (and thereby support a

53 '*Symbiocity*' views cities in an integrated manner, focussing on planning and policy (Ranhagen and Groth, 2012). Urban symbiosis is prioritised as it builds on industrial symbiosis and has a more distinct focus on management of resource flows.

city's climate strategies) by adopting an industrial/ urban symbiosis[54] approach. To do so, we conducted a detailed examination of a critical case study (Yin, 2009): the *Rotterdam Energy Approach and Planning* (REAP). REAP attempts to facilitate urban resource synergies across urban functions. It was initiated by Rotterdam's local authority, in partnership with architects and academic institutions in its design, and developers and energy companies in its implementation. REAP attempts to close resource-waste cycles locally, facilitating by-product reuse of energy and water flows.

To analyse REAP a critical case study methodology (Yin, 2009) was used. Data collection methods included: reviews of academic literature and policy documents, site visits, and 11 semi-structured interviews conducted from February 2012- April 2014 with representatives from Rotterdam's local authority, Technical University Delft, architecture companies, engineering companies, Amsterdam's Planning Department[55] and the Ministry of Infrastructure and Environment[56]. Topic lists, derived from theory-relevant variables and stages in project development, were used during interviews. Interviews were transcribed, coded on relevant categories and variables, analysed, and triangulated with each other and with literature, policy documents and site visits. The analysis of a single case study is limited when it comes to generalizable results; however, given the innovative nature of REAP as a case of urban symbiosis, an extensive single case study analysis was preferred above a quantitative analysis of a large sample (Flyvbjerg, 2004; Yin, 2009). While some literature on REAP's technical functions exists (Tillie *et al.*, 2009a; van den Dobbelsteen *et al.*, 2012), previous studies have not examined the organisational, policy and planning dimensions of REAP's design and implementation. Finally, initiated in 2009 REAP is relatively new, limiting measurements of its influence on Rotterdam's climate, energy and planning policies over an extended period. Still, REAP has been implemented in several projects and influenced policy developments.

The rest of this article is divided into four sections. Section 4.2 discusses industrial and urban symbiosis as the pillars of the article's conceptual framework, examining strategies to facilitate urban resource management. Section 4.3 analyses REAP in terms of urban symbiosis. Section 4.4 discusses the complexities of REAP as an urban symbiosis approach, followed by main conclusions on the roles of local authority in urban symbiosis in Section 4.5.

54 In this paper we view industrial and urban symbiosis as separate, but interrelated theoretical concepts. Urban symbiosis, while more relevant in that it focuses on urban resource management, is a more recent theoretical development that builds on the literature and experiences concerning industrial symbiosis. Consequently both were consulted in this study.

55 Amsterdam's Guide to Energetic Urban Planning used REAP as a guideline.

56 The national context brought to light local authorities' ability to enact energy criteria in buildings and planning, and for national support.

4.2 Industrial and Urban Symbiosis

Leading up to and following the 1992 *Earth Summit*, sustainable development became commonplace in policy and practice. In particular, industrial systems were scrutinised for unnecessary wastefulness. Adopting an ecosystem metaphor, Frosch and Gallopoulos (1989, page 271) stated, "The industrial system ought to be modified so as to mimic the natural ecosystem in its overall operation" – paving the way for the concepts of industrial ecology and industrial symbiosis. Industrial symbiosis offers a conceptual lens to examine linkages between (mainly industrial) organisations to raise environmental and resource efficiency. It is defined as the interaction between "traditionally separate industries in a collective approach to competitive advantage involving physical exchanges of materials, energy, water and by-products" (Chertow, 2000, page 12). Chertow *et al.* (2007) highlight three opportunities for industrial symbiosis: (1) by-produce reuse – materials exchanged between two or more parties to substitute raw materials; (2) utility/ infrastructure sharing – resources jointly used and managed; (3) joint service provision – ancillary activities across organisations via a shared system. Since initial discussions, scholars and practitioners have attempted to uncover unplanned examples or initiate planned symbiosis – the most prominent being Kalundborg, Denmark (Jacobsen, 2006; Chertow, 2007). Originated in the 1970s among five co-located companies and the local authority, Kalundborg gradually evolved into a complex web of symbiotic material and energy interactions, today covering over 20 by-product exchanges (Jacobsen, 2006).

Expanding on urban-industrial interactions, van Berkel *et al.* (2009b) introduced the idea of urban symbiosis to examine Japan's Eco-Town programme, which entailed recycling, town planning and outreach (van Berkel *et al.*, 2009b). There is room to examine other strategies where cities can facilitate by-product reuse and resource exchange (for example planning strategies that enable energy/ water exchange between industries and households or between urban functions). A more recent theoretical concept, urban symbiosis builds on attributes of industrial symbiosis, including: the technical-material functioning, economic rationale (e.g. generating new economic activities, improving resource efficiency) and environmental benefits (Baas, 2001; Côté and Rosenthal, 1998; van Berkel *et al.*, 2009b). But it differs from industrial symbiosis in that it focuses on a different social system: an urban system.

In industrial symbiosis, scholars have initiated a social science frame to understand the complex social dynamics of symbiosis, focussing on actors and institutions involved (e.g. businesses, government) and supportive factors (e.g. an atmosphere conducive to learning and dialogue which can build trust between partners) (Baas and Boons, 2004; Boons and Grenville, 2009; Gibbs and Deutz, 2007; van Koppen

and Mol, 2002). These social dynamics and factors are also relevant for organising urban symbiosis, be it specified for urban (instead of industrial) systems.

Ohnishi *et al.* (2012) developed a conceptual framework for analysing urban symbiosis with a focus on material recycling. It consists of: (1) recycling boundaries, (2) local collaboration and partnership and (3) government policy intervention. This categorisation aligns with other industrial and urban symbiosis research. For the purpose of this article, which examines urban resource exchanges at different geographic scales, recycling boundaries is replaced by geographic boundaries which is taken from industrial symbiosis literature (Chertow, 2000; Chertow, 2007, van Berkel *et al.*, 2009a) and appears more relevant for the study of REAP.

4.2.1 Geographic Boundaries

One of the most highlighted elements to enable symbiosis is geographic proximity, or the locational advantages through which place-based resource exchanges are facilitated in close proximity for environmental/ economic benefits (Chertow, 2000; Chertow, 2007; van Berkel *et al.*, 2009a). Chertow (2007, page 12) states, "The keys to industrial symbiosis are collaboration and the synergistic possibilities offered by geographic proximity." Ohnishi *et al.* (2012) recognise that different waste streams have different geographic boundaries to ensure maximum reuse efficiency. Within cities, urban infrastructure networks and building types could be reconfigured more effectively to manage resource flows (Hodson *et al.*, 2012; Monstadt, 2009; van den Dobbelsteen *et al.*, 2012). By doing so, cities could become less dependent on external resources, instead reusing resources already present in the urban environment (van den Dobbelsteen *et al.*, 2012). *The New Stepped Strategy* (van den Dobbelsteen, 2009) was designed to address urban resource consumption and waste production via three steps: (1) reduce demand by efficiency gains; (2) reduce waste outputs and reuse resources by recovery, cascading (from a higher to a lower energy source) and recycling; and (3) incorporate renewables to fulfil remaining demand.

Geographic proximity can also facilitate social relationships, enhancing trust between different actors to support resource exchanges (Chertow, 2000; Ohnishi *et al.*, 2012). Regional learning, wherein partners exchange knowledge on how to develop a local symbiotic system, is enabled by close proximity (Baas and Boons, 2004; Baas and Huisingh, 2008; Mirata and Emtairah, 2005).

4.2.2 Local Collaboration and Partnership

Symbiosis requires collaborative relationships between partners. As Côté and Cohen-Rosenthal (1998, page 198) highlight, "The lesson of Kalundborg are not found

in mapping its pipes, but in the unfolding of existing relationships. What makes Kalundborg a model is that its participants allowed and continued to encourage interaction; not that it had a particularly spectacular technical breakthrough." The development, implementation and evolution of symbiosis require learning new ways of working together to reuse resources and generate shared value, including: local engagement, trust, communication and dialogue (Baas and Boons, 2004; Cohen-Rosenthal, 2000; Gibbs and Deutz, 2007; Ohnishi *et al.*, 2012).

Local engagement is the glue that binds organisations together, facilitating access to information or resources (Baas and Boons, 2004; Gibbs and Deutz, 2007; Ohnishi *et al.*, 2012). This requires personal and professional relationships, common interest and ownership (Baas and Boons, 2004; van Koppen and Mol, 2002; Ohnishi *et al.*, 2012). Social relations amongst participants at inter-organisational levels may explain why certain symbiotic exchanges – especially those with minor short-term economic gains, and long-term strategic value – persist (Heeres *et al.*, 2004; Jacobsen, 2006).

Symbiosis requires that partners share information about production processes and by-products, find new ways of working together and build trust to generate shared products; in short: they become dependent upon each other (Baas, 2001; Cohen-Rosenthal, 2000; Gibbs, 2003; Ohnishi *et al.*, 2012; van Berkel *et al.*, 2009b). Continuous and reflexive learning based on dialogue and interaction can facilitate trust building, leading to knowledge/ resource exchange between partners, while enhancing new or fortifying existing relationships (Baas, 2001; Baas and Huisingh, 2008; Cohen-Rosenthal, 2000).

Open and frequent inter-organisational communication and dialogue not only generate trust and transparency, but encourage learning and enable knowledge spill-overs (Boons and Grenville, 2009; Baas and Huisingh, 2008; McCormick *et al.*, 2013). This includes horizontal communication between staff of different (sub) organisations or in the networks they participate in; and vertical communication between staff and top management within organisations (Heeres *et al.*, 2004, van Koppen and Mol, 2002). Challenges (e.g. technical malfunctioning) sometimes arise, especially during initial phases when sharing resources across organisational lines is new, revealing that, social and organisational elements, as well as technical knowledge, is required (Baas, 2001). Hodson *et al.* (2012) call for social learning from experimentation to upscale successful symbiosis initiatives.

4.2.3 Government Policy Intervention

The role of government in supporting symbiosis is two-fold: (1) nationally to provide legal and financial support; (2) locally to coordinate or promote symbiosis – often as

a local economic strategy (Gibbs and Deutz, 2007). Nationally, supportive laws, policies, regulations and subsidies can stimulate or steer symbiosis (Chertow, 2007; van Berkel *et al.*, 2009b; Ohnishi *et al.*, 2012). Locally, public authorities often provide an initiating/ coordinating function to steer urban symbiosis and facilitate action (van Berkel *et al.*, 2009a, 2009b; Ohnishi *et al.*, 2012). They may serve as symbiosis facilitator or promoter: taking responsibility, providing information, discussing economic advantages with private actors, identifying champions or encouraging legislation (Gibbs, 2003; Ohnishi *et al.*, 2012). As local authorities are accountable to their citizens and businesses, they must provide transparent information and foster trust amongst a broad range of urban stakeholders.

4.3 Rotterdam Energy Approach and Planning: A Case of Urban Symbiosis

Following the discussion above, this section analyses REAP as a case of urban symbiosis, addressing geographic boundaries, government policy intervention and local collaboration and partnership. First Rotterdam and REAP are introduced.

4.3.1 Rotterdam

With a population of 615,000, Rotterdam is the Netherlands' second largest city. It houses Europe's largest port, which was severely bombed during World War II. Afterwards Rotterdam had to be rebuilt, influencing its urban design and modern identity. Until recently, Rotterdam suffered from population decline, notably in its inner city (City of Rotterdam, 2012). Despite challenges, this presented a situation wherein vacant lots could be densified (e.g. new urban functions to facilitate resource exchanges).

A low-lying coastal city on a river delta, Rotterdam is also vulnerable to climate change, including sea-level rise, flooding from intensive rains or overflowing rivers. Simultaneously, it emits between 16- 25% of Dutch GHG emissions, mostly from the port (RCI, 2010; Gupta *et al.*, 2007). In 2006, Rotterdam joined the Clinton Climate Initiative (CCI), which brought financial resources to invest in testing innovative urban climate strategies, such as REAP, while encouraging dialogue and learning between global cities. After joining CCI, environmental considerations rose on Rotterdam's political agenda (Gupta *et al.*, 2007). In 2007, *Rotterdam Climate Initiative* (RCI) was established as a cooperation platform between government, companies, knowledge institutes, NGOs and citizens, jointly-managed by the Port of Rotterdam, Rotterdam Local Authority, employers' organisation Deltalinqs and Rijnmond Regional Environmental Protection Agency. RCI has three goals: to halve GHG emissions by

2025 (compared to 1990 levels); to design a climate-resilient Rotterdam by 2025; and sustainable economic development (City of Rotterdam, 2010). These goals are supported by the *Programme on Sustainability and Climate Change* and the *Mitigation Action Programme*; both specifically reference REAP.

4.3.2 Rotterdam Energy Approach and Planning

REAP builds on a former Dutch three-step energy approach initiated called *Trias Energetica*: (1) reduce energy consumption via architecture, (2) use renewable energy, and (3) supply remaining energy cleanly and efficiently (Tillie *et al.*, 2009b; van den Dobbelsteen *et al.*, 2009). This approach was reformulated, by adding an intermediate step between Steps One and Two: to reuse waste energy flows. This *New Stepped Strategy* was incorporated within REAP (Tillie *et al.*, 2009b; van den Dobbelsteen *et al.*, 2009). REAP follows three steps (the former Step Three of *Trias Energetica* was eliminated) and operates at four geographic scales: building, neighbourhood, district and city (Figure 4-1).

First, REAP emphasises energy efficiency. Second, waste energy flows are exchanged between urban functions. This requires attention to Rotterdam's planning strategy, to enable energy exchanges in close geographic proximity. Interviewees remarked that the most efficient energy is that which is already there, emphasising the harbour's waste heat. At the city scale, REAP emphasises the link between Rotterdam and its harbour industries, capturing and feeding waste energy flows into Rotterdam's district heating grid[57]. At the district or neighbourhood scale, offices and grocery stores almost always require cooling; their waste heat could be cascaded to heat homes (van den Dobbelsteen *et al.*, 2009). Similarly, swimming pools require heat; ice rinks require cooling. These energy streams could be exchanged. Focussing first on energy efficiency, the remaining heat or cooling demand could be provided via linking buildings with different energy demands (van den Dobbelsteen *et al.*, 2009). Third, renewable energy is encouraged for remaining demand.

From the start, REAP placed an emphasis on learning, dialogue and collaboration. It was launched in 2009 with a six-month study consisting of eight interactive workshops and 20 meetings, including themes on: linking energy and urban planning, reducing and inventorying waste flows at different spatial scales, and producing renewable energy. Meetings were coordinated by the City Development and Public Works Departments, and attended by local politicians, civil servants, economists, the

57 Rotterdam incorporated district heating starting in the 1950s – first gas, now waste incineration. New developments are obliged to connect; however logistical challenges remain (e.g. monitoring is limited; even if connected, building owners can decide whether to use it).

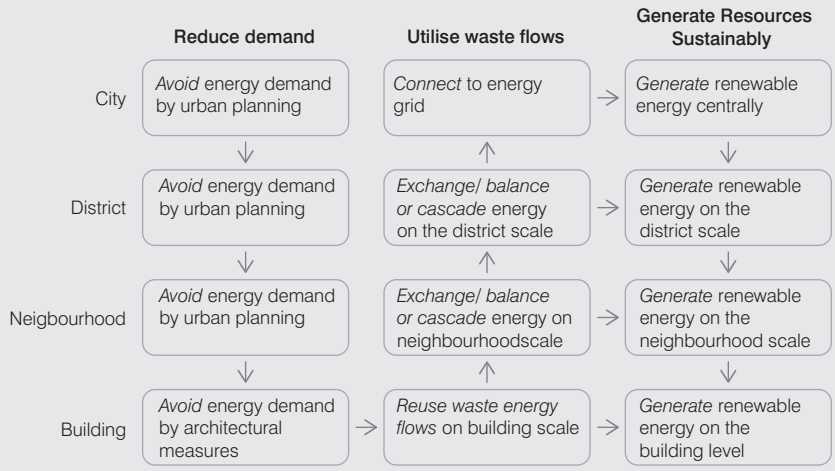

Figure 4-1 REAP Methodology, Building on the New Stepped Strategy[58]

Regional EPA and local energy companies. REAP was subsequently discussed by City Council and adopted by RCI. Since RCI adopted REAP, by default all of its partners have.

To date, several projects (of varying geographic scale) have applied REAP (see Table 4-1 for details). The most commonly referenced is *Hart van Zuid*: a large-scale retrofit, which includes additional housing, offices and cultural spaces on vacant lots. While not CO_2-neutral, it comes closer than past projects emphasising energy efficiency and reuse. Some interviewees cautioned optimism regarding its final outcome, noting developers must adhere to multiple criteria (e.g. affordability, accessibility). Only economically feasible REAP elements will be incorporated. As REAP's cost savings (e.g. from energy savings) become more apparent, interviewees indicate REAP's acceptance and implementation is increasing. Other REAP sites include the *Stadshavens:* former port areas redeveloped as mixed housing/ commercial districts. Closed-system energy exchange is also tested in buildings.

58 Adapted from Tillie *et al.* 2009b

Table 4-1 Selected REAP Projects[59]

Project	Location (in Rotterdam)	Project Description and timeline	REAP Scale and Priorities
Hart van Zuid	South Rotterdam, south of Maas River	Retrofit of existing housing, cultural and commercial district (Built: 1960s-1980s Ongoing redevelopment, 20 year timeline)	District scale Energy efficiency Energy Exchange/ Cascading between urban functions
Stadshavens	South and west Rotterdam	Former industrial port, redeveloped as housing/ commercial district, run on captured industrial waste heat (Ongoing development, 40 year timeline)	Neighbourhood scale Energy efficiency Cascading (e.g. from flour production at Meneba Plant)
De Rotterdam	Central Rotterdam, Wilhelminapier on Maas River	High-rise with offices, housing and commercial services (Complete 2014)	Building scale Energy exchange in a building
Merwe Vierhavens	West Rotterdam, on Maas River	Subsection of Stadshavens, ongoing study of REAP2	Neighbourhood scale Pilot of REAP2 (energy and water exchange)
Haka Building	West-central Rotterdam, near IJsselhavens	Retrofit of existing high-rise with housing and commercial services, ongoing study of REAP2 within existing building (Built 1932)	Building scale Pilot of REAP2 (energy and water exchange)

59 Source: City of Rotterdam, 2013

Conceptually, REAP's emphasis on closing resource flows is applied to Rotterdam's new *Heat and-Cold Vision*[60] which was developed in collaboration with Rotterdam's three largest housing corporations and two Dutch energy companies (ENECO and NUON). Bringing stakeholders together, Rotterdam could adopt a more ambitious district-heating target. Previously connecting 55,000 homes by 2035 was considered feasible; later partners agreed to connect 155,000 homes by 2035. Meanwhile REAP2 was launched in 2012, including water and energy exchanges, with a similar emphasis on three steps and four scales (van den Dobbelsteen *et al.,* 2012) tested at neighbourhood and building scales.

Many cities prioritise renewable energy, energy efficiency or district energy; few however connect energy and urban planning in one strategy to facilitate symbiotic energy-related priorities at different geographic scales. According to a City Development Department representative, REAP's greatest strength is bringing energy planning terminology to urban planning and *vice versa*, by working across organisational lines with different departments and actors. REAP thus challenges "silo thinking" or singular policy targets, instead enabling discussions on a common vision. Hence REAP is rather unique, offering a method also for other cities: Amsterdam's *Guide to Energetic Urban Planning* uses REAP's methodology. REAP is also used in Manchester University's *GRIP Scenario Tool* (GHG Regional Inventory Project) and in the EU *Celsius Cities* project to test smart energy planning in other European cities: Gothenburg, Genoa, London, Cologne and Rotterdam.

4.3.3 Geographic Boundaries

REAP was originally designed to operate at the city-scale, facilitating place-based resource exchanges across Rotterdam's urban landscape (Tillie *et al*., 2009b). To ensure maximum efficiency however, REAP operates at different geographic scales, depending on locational advantages of particular resource exchanges (e.g. energy vs. water exchange, quantity of resource exchange). For larger resource exchanges, focussing on the city-level makes sense (e.g. reusing industrial waste-heat or incineration). To best optimise symbiosis, Rotterdam would need to reconfigure its infrastructural (heating) network, creating more direct links between the city and harbour. This is however a long-term approach. For smaller resource exchanges, the building or neighbourhood may be preferred (e.g. cascading heat from offices or grocery stores, exchanging heat/ cooling between swimming pools and ice rinks). REAP's emphasis on flexible geographic boundaries was considered a strong point by all interviewees. However, some noted that while on paper direct resource exchanges make sense, they were sceptical about the feasibility of reconfiguring

60 This Vision includes captured biogas from sewage sludge and waste heat from a data-centre.

energy and water networks to enhance symbiosis between buildings, services and industries. Rarely are ice rinks and swimming pools in sufficient proximity to make exchanges economically viable. To do so will take time, as buildings and infrastructure evolve. However, an advantage in Rotterdam is its low density, providing an opportunity for urban infill and localised resource exchanges.

Interviewees and policy documents also highlight how REAP can support local economic development. Optimal reuse of waste energy and water flows in urban settings requires coordination, for example an urban resource-exchange manager to match supply and demand across different energy activities, creating new economic activities (e.g. for a district heating company). REAP can also result in energy cost savings for the local authority, businesses and city-dwellers. Via continued dialogue among stakeholders and REAP participants, other urban symbiosis strategies may come to light (e.g. wastewater exchanges in REAP2).

Some interviewees criticised REAP for not fully taking advantage of geographic proximity. The name *Rotterdam Energy Approach and Planning* prioritises energy as its central focus, with urban planning as a secondary focus. A different name, with a stronger emphasis on mixed-use urban planning (i.e. integrating residential, commercial, or industrial uses in close proximity) could better capture the advantages of urban densification. Accordingly, different urban functions, and their energy/ water uses and potential exchanges, would occur by default in close(r) geographic proximity. An engineering company representative remarked that resource exchanges are often more cost-efficient, resource-efficient and logistically feasible to administer in close proximity.

While not one of REAP's main goals, mixed-use urban planning offers additional benefits, such as deterring suburbanisation. Suburbs largely have a larger per-capita resource footprint, compared to denser urban environments where systems like public transport or district heating are more feasible (Hoornweg *et al.,* 2011). In this interpretation, REAP is more than energy cascading or exchange; it is a planning model to capitalise on the benefits of urban density and geographic proximity to design more resource-efficient/ mixed cities. Another strategy takes geographic proximity into consideration: *Rotterdam – People Make the Inner City: Densification and Greenification = Sustainable City.* This strategy mentions that by locating urban functions strategically, heat and cold could be cascaded or exchanged.

4.3.4 Local Collaboration and Partnership

In part because of heavy resource consumption in its harbour, Rotterdam was one of the first Dutch cities to "put sustainability on the map" according to interviewees.

Rotterdam Harbour was home to a former industrial symbiosis project, *Industrial Ecosystem* (INES) that addressed by-product reuse of energy/water and joint-service provision (e.g. joint system for compressed air) by industries. INES participants, including *Europoort/Botlek Industrial Association*, individual industries, governmental authorities and scientists, emphasised reflexive learning, dialogue, partnership and monitoring (Baas and Boons, 2004). According to an interviewee, through INES Rotterdam's local authority gained experience on utilising and exchanging resource flows and found new ways to work with partners, leading to lasting relationships with key actors in Rotterdam Harbour. Building on INES and RCI, discussions on closing resource-waste cycles and addressing GHG emissions moved from the harbour to the city, resulting in REAP[61]. Via INES, Rotterdam gained the expertise, technical knowhow and professional and informal relationships to support urban symbiosis.

Developed under RCI's guidance, REAP initially included Rotterdam's technical and urban planning departments, Technical University Delft and two architecture bureaus, bringing spatial planning and energy planning experts together. They all shared a common interest in reducing Rotterdam's resource consumption and GHG emissions footprint(s) and ownership of REAP's development. The eight initial participants met every two weeks over six months to operationalise REAP, including how it should be organised. The small initial group provided an informal atmosphere with open communication. An engineer involved in REAP2 commented that REAP's dialogue was "very free, allowing new ideas to manifest in a trusting environment, leading to concrete proposals". REAP consequently moved from an abstract idea based on a set of policy priorities about energy efficiency, to a tangible operationalised concept with three steps and four scales, bringing energy distinctly into Rotterdam's urban planning.

Private-sector stakeholders (e.g. urban developers, energy companies) were included only later, by informing them how to apply REAP's methodology. Some initial participants claimed this was partly because initially REAP was conceptually abstract and technically complex. To avoid early failure, core participants first aimed to reach consensus on an internal vision within the local authority that could be communicated to external (private) actors. However, late inclusion of private stakeholders had consequences: interviewees indicate a general lack of private-sector ownership, at least initially. This lack of ownership proved also in only partial acceptance and ad-hoc application of REAP's three steps.

61 Other symbiosis efforts remain focussed on Rotterdam Harbour, since it still represents Rotterdam's largest source of GHG emissions.

REAP2 involved an expanded project team, including an engineering company to explore cascading and storage feasibility, and a law firm to study the legal ramifications of REAP's implementation. To develop acceptance, the local authority hired an external consultancy (*Royal Haskoning DHV*) to identify REAP's energy and cost-saving benefits and communicate these to energy companies and housing corporations, using the *Delphi Method* (i.e. structured communication using interactive forecasting techniques). Through continued interactions among these actors, trust has increased and participants speak more freely about REAP's mutual benefits.

Another challenge is the expressed hesitation to become resource dependent on others, especially as some urban functions may shift with time (e.g. improved efficiency could reduce energy availability; offices, swimming pools or stores could relocate). This is a common concern identified in the symbiosis literature (Gibbs, 2003; Ohnishi *et al.*, 2012). REAP proponents underscored continued dialogue to build confidence among resource exchangers on co-dependency, while emphasising a diverse assortment of energy resources (e.g. cascading, exchange, renewable energy). Meanwhile, the local authority conducted GIS mapping exercises with housing corporations and energy companies to demonstrate existing and future energy exchange potential in Rotterdam. To assure reliable energy provision, one suggestion was to appoint a REAP "middleman" accountable for matching energy supplies. The district heating company (*Warmtebedrijf*) serves this function. Initially hesitant, fearing to lose customers, interviewees indicate that *Warmtebedrijf* shifted its position when realising it could develop new customer relationships as REAP's middleman.

In its design and implementation, REAP emphasises dialogue, including via workshops, informative sessions and meetings with local politicians and private developers. Vertical and horizontal communication strategies are emphasised in two EU-funded projects: Celsius Cities and MUSIC (*Mitigation in urban areas: solutions for innovative cities*) that specify dialogue and flexibility. *Celsius Cities* suggests using demonstrations, continuous learning, understanding stakeholder perceptions, market integration and monitoring.

Most stakeholder dialogue efforts within REAP however remain concentrated on institutionalised actors. Until now, city-dwellers are rather neglected, even if they are an important (final) user-group. Interviewees pointed to other activities to engage residents in energy discussions. The local authority invites young people to interactive renewable energy workshops with local politicians (i.e. aldermen) and uses social media to engage citizens.

4.3.5 Government Policy Intervention

Given its relevance to address climate change, REAP is placed in the context of national and local climate strategies. Nationally, the Netherlands was one of the first countries to develop a climate policy in the early 1990s, calling for stronger integration between environmental and spatial policy and transferring responsibilities to lower government (Gupta *et al.*, 2007). Despite early forerunner status, national climate policy is currently less prioritised; support for local climate strategies (e.g. REAP) has also reduced. Moreover, due to changes in the *Building Decree* in 2012, minimum energy efficiency requirements in buildings are set nationally. Local authorities can encourage developers to use more stringent requirements, but they cannot legally oblige developers to commit to anything other than the national standard (den Exter *et al.,* 2014). Additionally, in Dutch energy labelling schemes district heating is not valued on par with renewable energy installations per building-unit (e.g. rooftop solar). Since REAP optimises reusing primary energy (thus reducing the need for renewables) Rotterdam's local authority lobbied national authorities to improve district heating valuation in energy labelling schemes to incentivise housing corporations with improved property values.

Locally, after Rotterdam joined CCI (and with RCI's development) climate strategies were prioritised. Former mayor Ivo Opstelten (1999-2009) encouraged flexible approaches to address Rotterdam's emissions that build on past efforts (e.g. INES) to optimise energy cycles, leading to REAP. Developed under RCI's guidance, REAP meetings were coordinated by Rotterdam's City Development and Public Works Departments, but always connected to local politicians and/or directors of other departments to ensure local policy coherence and political backing. The Public Works Department (Rotterdam's internal consultancy responsible for technical projects) guides developers, energy companies and local businesses in REAP implementation.

Due to a lower prioritisation of climate change nationally, and national-level changes (e.g. *The Building Decree*) which limit local autonomy in setting local energy efficiency standards, Rotterdam does not have the legal grounds to mandate REAP's implementation. This negatively affects the local authority's ability to govern REAP's implementation and monitoring. As a result: during the design phase, the local authority enacted a rather exclusive approach with few participating organisations; during implementation, the local authority stepped back using few steering measures. Despite this, interviewees stressed continued dialogue to encourage REAP's acceptance and implementation as it evolves. Meanwhile Rotterdam is developing a new *City Vision* and *Heat and Cold Vision*; both build upon REAP.

REAP received financial support from several levels, emphasising its prioritisation among Rotterdam's climate strategies, while ensuring resource stability for development. At the European level, REAP is connected to MUSIC and Celsius Cities which indirectly allocate resources. At the national level, REAP was supported by the *Peaks in the Delta Programme* and *Port City Project*. At the local level, RCI is the main funding source, designating work hours and finances for data collection, workshops and project materials. Now operational, interviewees indicate less funding is required; REAP serves as an implementation guideline.

REAP was designed to incorporate flexibility and adjustment. While it has clearly stated principles and priorities, these can be applied with greater or lesser stringency. A long-term goal is to incorporate direct energy exchanges; in the short-term REAP serves as a "thinking method". The Public Works Department, when consulting with private developers or other departments, encourages partners to design with "energy infrastructure in mind." Developers are invited to information meetings, provided REAP guidelines and offered advice. Current projects are not "zero-energy" but implementers learn to incorporate the three steps as standard practice. Noting REAP's continued evolution, one interviewee remarked, "REAP is a way towards the solution, not the solution itself." This deliberate emphasis on REAP as an evolving process was appreciated by some participants. An engineer noted that instead of strict targets, REAP encourages flexible thinking. He recognised that while these approaches take time and do not always meet initial expectations, they can lead to innovative energy and urban planning methods and integrated city visions. An architect was more critical, claiming REAP has not reached its full potential; he suggested local authorities better emphasise management, coordination and follow-up of all three steps to reach its vision, stating "REAP is not dead; but it is sleeping..."

Despite varying perspectives concerning REAP's achievements until now, all interviewees echoed similar expectations regarding REAP's long-term influence on Rotterdam's urban climate strategies, its energy and urban planning strategies, and quality of life improvements.

4.4 Discussion

In this paper REAP is examined as a case of urban symbiosis regarding its efforts to foster synergies in urban resource consumption and waste production across urban functions – and in doing so, to also support a city's urban climate strategies. From this, four points merit our attention: (1) the central role of the local authority during

REAP's design phase (although less so during implementation), (2) the need to increase participation of private-sector stakeholders in earlier stages to improve ownership and implementation, (3) the dominance of institutional actors, as opposed to city-dwellers, and (4) the possible challenges facing the governance of urban resources when transitioning from a traditional (or separate) urban resource management approach to an integrated urban resource management approach.

Firstly, the active presence of public-sector stakeholders (at least during REAP's initial development) aligns with research in both urban symbiosis and urban climate governance (Bulkeley and Castán-Broto, 2012; Van Berkel *et al.*, 2009a, 2009b; Ohnishi *et al.*, 2012). In its initial stage(s), REAP is predominantly 'led' by the local authority, with architects and academics included in the design stage. In later stages, housing corporations, energy companies and infrastructure providers were brought in. The local authority serves as coordinator, facilitator and information provider. This is in part because of REAP's nature, which attempts to address energy and urban planning simultaneously; and the possible ambiguity of this approach, which could lead to internal fragmentation if different departments (with competing perspectives and priorities) disagree. Checkland (2000) acknowledges that often multiple perspectives co-exist and that full agreement is nearly impossible. To limit competing perspectives or possible (internal) fragmentation, the local authority initially acted rather introverted, developing an internal vision primarily among its departments; external partners were largely engaged only later. Still, any strategy aiming to reconfigure urban infrastructure will eventually be enacted within the (existing) urban fabric. Accordingly, those persons or organisations who can influence, will be influenced, or have the power to reject (or ignore) a particular strategy's implementation should be involved (Checkland, 2000) already in the design phase to increase acceptance or avoid (external) fragmentation.

Thus, secondly, in addition to the local authority, urban symbiosis should include those who serve as implementers, notably private stakeholders earlier on to increase implementation. In this way, REAP could learn from existing studies in industrial symbiosis, which call for active collaboration among all partners (Chertow, 2000). Moving from design to implementation, the local authority took a step back in the case of REAP: providing information, support and stimulation, but making limited use of regulatory measures. We see two obstacles facing private ownership and engagement with this approach. The limited engagement of private stakeholders (i.e. implementers) during the design phase has reduced their ownership and acceptance during implementation. Moreover, the local authority has not utilised strong policy tools to steer towards REAP; instead it has enacted more of a "hands-off" approach during implementation. From what we witnessed, additional efforts are needed to

better engage the private sector. While this has improved in REAP2, a stronger emphasis on dialogue and participation, inviting participants to take part in a "lively, playful" experience (Checkland, 2000, page 822) already in the design phase, could improve private-sector ownership and adherence, and implementation. The downside of this is that broader initial representation may result in less focussed (or less ambitious) objectives, or take more time to organise and conclude. While ambitious objectives are important they mean little without implementation.

Thirdly, large-scale institutional actors dominate in REAP: project developers and housing corporations, energy companies, port authorities, industries and local businesses. Less involved are city-dwellers, although, as end-users, they represent an important stakeholder group. Rotterdam engages citizens via related strategies (e.g. *Rotterdam – People Make the Inner City*) but their role within REAP is limited, at least in the short-term. Participation of city-dwellers in urban symbiosis will require efforts focussed on communication and outreach to explain what REAP is and its benefits, as well as possible discussions with, for example, local businesses or neighbourhood groups on how they can become involved in such resource exchanges. Interviewees questioned whether it was more important that city-dwellers know the "REAP brand" or understand the concepts behind it (e.g. energy efficiency, energy exchange, renewables).

Finally, perceiving Rotterdam's energy (and water) resources as part of an integrated system, REAP reveals and challenges "silo thinking" in that resources, and the urban functions they relate to, are generally viewed as separate rather than integrated systems. REAP calls for a more integrated urban resource management approach, which may not always align with existing governing systems or institutional arrangements. This is one of the complexities highlighted in the existing (industrial) symbiosis literature. Baas and Huisingh (2008) state that symbiotic arrangements do not occur in a vacuum, but are embedded in existing (e.g. political, legal, technical) systems. For example, an architect may design a building with rooftop solar thermal panels, but from a systems' perspective it may prove more efficient to cascade existing energy – thereby preventing the need for additional energy sources, renewable or otherwise. Dutch law however does not equally value district energy and onsite renewables. To address this, the local authority lobbied national government for its inclusion. Similarly, the local authority facilitated a dialogue between housing corporations and energy companies to discuss energy consumption within existing buildings that led to prioritisation of district heating in Rotterdam's most energy-consumptive buildings. In both cases, REAP reveals the need to find new strategies to support more synergistic approaches to urban resource management. To do so, it encourages bringing relevant actors together in a common

dialogue. Still, implementation of REAP remains a slow process. To ensure its sustained influence will require continuous learning, conversation and debate (Checkland, 2000).

4.5 Conclusion

In light of the complex and emerging challenges and scientific and policy discussions that increasingly suggest local action, this article reviewed the *Rotterdam Energy Approach to Planning* (REAP) to examine the role of local authorities and other actors to facilitate synergies in urban resource management. Taking an urban symbiosis/ industrial symbiosis lens, it examined REAP's attempt to facilitate resource synergies in a city, across and between different urban functions.

The case study invokes a number of considerations for designing and implementing urban symbiosis. Firstly, REAP illustrated the advantages of adopting a flexible approach regarding geographic scale (e.g. at building, neighbourhood, district and city-level) depending on the type and amount or resource exchanged and the stakeholder constellation involved. Secondly, REAP illustrated that it may be beneficial to encourage early involvement of private stakeholders and civil society (or better: those responsible for implementation) as it improves ownership and engagement. This was not the case in REAP, and may be one reason for their lack of ownership. Thirdly, hesitations remain regarding (too much) resource dependency. In industrial symbiosis, an emphasis is placed on rules, routines and networks to strengthen relationships, build trust and advance trade of local material and non-material assets (Gibbs, 2003). Encouraging continued dialogue, interactions and learning may enhance project acceptance while developing new resource alliances in urban symbiosis (e.g. a middleman to coordinate resource provision). Fourthly, while urban symbiosis depends on private-sector implementation, we also witnessed the need for local government steering in the implementation phase. Such local authority support can nevertheless be challenged by changing political and financial climates, weakening resource availability and legitimacy of such guidance and support. Identifying and highlighting best practices or champions (Gibbs, 2003; Ohnishi *et al.*, 2012) or cost savings of such projects (Chertow, 2007) as done in industrial symbiosis, could build support for urban symbiosis to find stabilised footing among competing priorities in compromised political and financial climates.

When the focus on symbiosis moves from industrial parks to the city (at least in the case of REAP) some distinctions emerge: government authorities, notably local authorities play the dominant role; a larger and more diverse set of large (and small)

actors are engaged in urban resource exchanges (in particular during implementation); and a larger and more diverse set of existing buildings, infrastructure and (urban) functions influence the implementation of urban symbiosis. As such, while urban symbiosis builds on the complex nature of industrial symbiosis taking place in eco-industrial parks, it brings new and additional complexities from a social organisation and governance point of view, especially if multiple resources (energy, water, solid materials) are exchanged in a city, since cities generally include a more diverse set of actor constellations (from companies, to citizens) compared to industrial parks.

As cities reinterpret planning and energy strategies in light of climate change, REAP provides one method of how cities can facilitate improved urban resource management, by adopting an urban symbiosis approach. On paper it demonstrates the technical/ environmental components of urban symbiosis; in reality it also illustrates the organisational and institutional complexities of symbiotic approaches – even if to date it has not engaged with resources other than energy and water. Whether REAP will do for urban symbiosis what Kalundborg has done for industrial symbiosis will depend on implementation successes, including improved collaboration between public and private actors, beyond a few pilot projects.

Accordingly, future research could conduct a longitudinal study of REAP to observe its influence in Rotterdam; or compare similar urban symbiosis strategies in other cities, where different stakeholder constellations are involved in the process and when such stakeholders are brought into the process (i.e. in the design phase or implementation phase). REAP's four scales and three priorities inspired other sustainability guidelines in Rotterdam (e.g. on mobility, water, materials and green space). Future research could examine how these guidelines interact or influence Rotterdam's goal to develop an integrated system of urban resource management, while also addressing climate change mitigation and/or adaptation.

5

Urban Food Systems in a Time of Climate Change: the Case of Amsterdam[62]

62 This paper has been submitted to *Local Environment* and is currently under review by: J. Lenhart, B. van Vliet and A.P.J. Mol.

Abstract

The modern food system both contributes to and is affected by climate change. While this connection between food systems and climate change is widely recognised at the global level, it is less so at the local level in cities. Local government authorities rarely link urban food strategies and urban agriculture to their climate strategies, although urban food strategies and urban agriculture can help a city achieve its climate goals on mitigation and adaptation. This article analyses this opportunity by investigating relations between urban food strategies, urban agriculture and urban climate strategies, and what the benefits are of aligning urban food to urban climate strategies. An in-depth case study is conducted in Amsterdam, examining its Food Vision and urban agriculture initiatives through policy document review, in-depth interviews and participatory observation at urban food events and Amsterdam-based community gardens. A strong presence of and interest in local food production and consumption is observed, from top-down and bottom-up. Meanwhile, Amsterdam's Food Vision and urban agriculture initiatives are found to be implicitly relevant for climate mitigation and adaptation; however they are not made relevant. Making them explicitly relevant for urban climate policy could entail: promoting urban agriculture as a community-managed urban greening strategy, using climate finance to support urban food strategies, and using urban agriculture in climate communication campaigns.

5.1 Introduction

We live in an era facing multiple, complex and interrelated environmental challenges, with human-induced climate change recognised as one of the most profound challenges. Addressing climate change requires mitigating greenhouse gas (GHG) emissions, while adapting to the changes associated with a warming planet (Howard, 2009; Satterthwaite, 2014; Wilbanks and Sathaye, 2007). Many of society's modern and global socio-technological systems (e.g. energy, transport, housing, water and wastewater, industrial production) have been analysed in relation to climate change mitigation and adaptation. More recently, the global food system has also been analysed in climate change studies. The modern food system with its emphasis on large-scale farming, industrial efficiency and long distances between production and consumption was "designed" to facilitate affordable and predicable access to safe food. However, it is increasingly recognised that this global food system has externalities, including its contribution to climate change. Concerning climate change, the food system is responsible for circa one-third of GHG emissions, from activities including: land use change, fossil fuel use and methane emissions (Gilbert, 2012). Equally, the global food system is vulnerable to climate change consequences, including changing rainfall and temperature increases (de Zeeuw, 2011; FAO, 2010; Schmidhuber *et al.,* 2007). At the global level, this interrelationship between the food system and climate change has raised concern, resulting in collaborations between international organisations, nation-states and private sector actors, and the consequent publication of many reports (Cline, 2007; Nelleman *et al*., 2009; FAO, 2010).

Remarkably, within cities this sense of urgency and subsequent policy initiatives on the food-climate change nexus is less present or hardly articulated. This is even more surprising since in both climate change and food system challenges, cities function as key nodes. Presently over 50% of the global population resides in cities and urban areas (UN-Habitat, 2008) and cities are responsible for 40-70% of GHG emissions (IEA, 2008; UN-Habitat, 2011). Equally, cities are vulnerable to climate change, including exacerbated urban heat island (UHI) effect and flooding of non-porous surfaces (Revi *et al.,* 2014; Kleerekoper *et al.,* 2012; UN-Habitat, 2011). Cities are thus recognised as an appropriate platform to address mitigation, adaptation and broader sustainability concerns; and increasingly cities – individually and in networks – take responsibility in climate policy (Bulkeley and Castán-Broto, 2013; Revi *et al.,* 2014; Satterthwaite, 2014; UN-Habitat, 2011).

Cities are also key nodes in the food system. Currently, cities are largely perceived as places of food consumption, more than food production; but this has not always been the case. Historically the majority of a city's food was grown in the urban

periphery (Steel, 2008). Following the Industrial Revolution and later the Green Revolution, the periphery expanded, using modern transport and farming techniques to increase efficiency (Steel, 2008). Food production and provision became a rural – less an urban – concern (Morgan, 2009; Pothukuchi and Kaufman, 1999; Sonnino, 2009). In most cities there has largely been an absence of urban food policy over the past decades (Morgan, 2009; Pothukuchi and Kaufman, 1999; Thibert, 2012). But this is changing. As the modern food system faces mounting challenges that (can) disproportionately affect cities (e.g. food riots from increased prices; food safety concerns; health concerns such as obesity; climate change), local authorities are beginning to reintegrate food systems in the urban policy agenda (Cohen and Reynolds, 2014; Morgan, 2009; Morgan and Sonnino, 2010). As a result, local authorities together with stakeholders (e.g. local food advocates) are developing urban food strategies; meanwhile citizens are calling for and engaging in local food alternatives, sometimes literally "taking matters into own hands" in the form of urban agriculture.

Nonetheless, these new urban food strategies and citizens' urban agricultural initiatives are rarely profiled, designed or interpreted as urban climate strategy by local authorities or citizens – not even in cities with progressive climate strategies, where urban food strategies and urban agriculture are prevalent. We see this as a missed opportunity. Hence, this article examines why cities pursue urban food strategies and urban agriculture, and how and with what benefits these strategies can relate to urban climate (mitigation/ adaptation) strategies, explicitly or implicitly. To do so we conducted a best practice case study (Yin, 2009) on Amsterdam. Historically and presently, Amsterdam is a food trade hub; it was also one of the first European cities to adopt an urban food strategy (Morgan, 2009). Amsterdam has an active presence of local food activists and over 70 urban agricultural initiatives[63]. For Amsterdam we analyse possible synergies between urban food strategies/ urban agriculture and urban climate/ sustainability strategies, and whether a more coherent and explicit connection could benefit existing climate change efforts.

Data collection methods include an examination of academic literature and policy documents (e.g. urban food strategies, climate/ sustainability strategies); 12 semi-structured interviews conducted with Amsterdam local authority representatives, local food NGOs and entrepreneurs; events attended linking urban food systems and climate change (e.g. 2013 *ICLEI Resilient Urban Food Systems Forum*; 2013 *Farming*

63 We focus on public urban agricultural initiatives led by communities, companies or schools that facilitate learning, collaboration and dialogue. Size and scale vary (several meters to several hectares) as do their participation (5- 30 volunteers).

the City Book Launch); and participatory observation in two Amsterdam-based[64] urban agricultural initiatives (2012- 2014) where conversations were held with circa 40 urban agricultural volunteers. Finally, we compared *Amsterdam's Food Vision* with two other European best practices (Moragues *et al.,* 2013): the *Healthy and Sustainable Food for London* (2007) and Malmö's *Policy for Sustainable Development and Food* (2010).

After discussing the relationship between cities and food systems, the next section examines Amsterdam's urban food strategy and urban agricultural initiatives. This follows with an analysis of the relationship between urban food strategies/ urban agriculture and urban climate strategies in Amsterdam, comparing it to Malmö and London. Finally conclusions are drawn on the opportunities to link urban food strategies with a city's climate agenda.

5.2 Cities, Food Systems and Climate Change

5.2.1 A Historic and Dynamic Relationship

The modern relationship between cities and food systems is a linear one; food is produced in the (global) periphery, transported and consumed in the city, and disposed of in the periphery (Steel, 2008). The larger the city, the more it follows this linear pattern, drawing not only on its own hinterland, but on a global periphery for food production, contributing to climate change and other challenges (Girardet, 2010). This unsustainable relationship between food and cities – the decoupling of food production from urban food consumption – is however, a recent phenomenon (Thibert, 2012).

Historically the relationship between agriculture and urbanism was symbiotic: food was produced in the urban periphery, consumed in the city, with organic wastes providing nutrients for soil fertility in the urban periphery (Girardet, 2010; Steel, 2008). With the onset of the *Industrial Revolution* in the 1850s, food was produced and delivered from further afield, transported on railways and later by roads, freight and air; cities thus sprawled onto arable lands surrounding them (Steel, 2008). With the onset of the *Green Revolution* in the 1940s- 1960s, this changing relationship between food and cities became a global phenomenon. The Green Revolution is credited for saving a billion people from starvation; however it was heavily dependent on agrochemicals and machinery run on crude oil (UNCTAD, 2013). Moreover, it resulted in a shift from subsistence farming to monocropping for export and animal feed – expanding food production to a global periphery.

64 See: http://luistervink-amsterdam.org and http://www.icanchangetheworldwithmytwohands.nl.

As farming practices and the urban fabric changed, so did the governing of urban food systems. In pre-industrial food systems, public authorities (e.g. nobles) were generally responsible for food production, provision, pricing and distribution, with food sold in public open-air markets for regulatory purposes (Steel, 2008). In post-industrial food systems, private actors serve those functions, with supermarkets as the main distribution centres (Steel, 2008). As the link between food systems and cities dwindled, with food provision handled by the private sector, food was viewed as a rural, not an urban, policy concern (Morgan, 2009; Pothukuchi and Kaufman, 1999). Still, while food production is largely rural, the food system is relevant for urban policy, including: public health, land use, energy and waste (Morgan, 2009; Pothukuchi and Kaufman, 1999). Due to challenges including climate change, research suggests there is a growing recognition to reconnect cities and food systems; to do so, local authorities and stakeholders (e.g. NGOs, local food entrepreneurs, food retailers) play a critical role, developing urban food strategies and supporting local/ regional food production, including urban and peri-urban agriculture[65] (Moragues *et al.,* 2013; Morgan, 2009; Morgan and Sonnino, 2010; Sonnino, 2009).

5.2.2 Reintegrating Cities and Food Systems

Over the last decades, urban agriculture has received greater attention in academic and policy debates, expanding in cities across the globe (Cohen and Reynolds, 2014; Pothukuchi and Kaufman, 1999; Thibert, 2012). Urban agriculture, however, is not a new or modern phenomenon. In many African and Asian cities[66] it is commonly practiced to improve food security, supplement incomes and ensure a fresh food supply (Sonnino, 2009; Thibert, 2012). In European and North American cities, urban agriculture was regularly practiced until the 19th Century, despite advances to modern agriculture (Thibert, 2012). During World War I and II, governments in Europe and North America enacted policies to encourage citizens to plant *Victory Gardens* to redirect the food supply to their respective soldiers (Barthel *et al*., 2013; Dixon *et al.,* 2009). In the U.S. alone, 40% of food was provided by Victory Gardens during WWII (Dixon *et al*., 2009). From the 1950s-1960s urban agriculture experienced a decline, but re-emerged in the 1970s as a community revitalisation strategy addressing environmental challenges and social inequalities (Cohen and Reynolds, 2014). In the 1980s Food Policy Councils emerged, largely in North America, to coordinate action on food access, public health and community development (Thibert, 2012). Consisting of private and public actors, Food Policy Councils mainly have an advisory

65 Urban agriculture is agriculture grown in the city, usually smaller in scale and based on voluntary labour. Peri-urban agriculture is grown in a city's periphery. Smaller in scale than industrial agriculture, professional farmers often maintain peri-urban farms (FAO, 2010). In this paper, we refer to urban agriculture; city food strategies may also consider peri-urban agriculture.

66 FAO (2010) estimates 70% of urban households in developing countries participate in urban agriculture.

role and cannot enact policy (APA, 2011). Following this, local authorities (in consultation with stakeholders) began to enact urban food strategies, placing food systems formally on the urban policy agenda: the first large European cities to do so were Amsterdam and London (Morgan, 2009).

Simultaneously urban residents' food preferences are changing. Increasingly urbanites demand local, seasonal, organic or ethically sourced (e.g. Fairtrade) products for reasons including: health and nutrition, environmental concerns and social justice (Deelstra and Girardet, 2000; OTA, 2011). While this "sustainable food" fraction remains limited in the Netherlands (6.1% of total consumption in 2013) it is growing: in 2013 organic food was the most important, and in many cases only, growth market in Dutch food retail (LEI, 2014). Organic food consumption grew 10.8% between 2012- 2013, to roughly -2.46 billion (LEI, 2014).

Concerning urban agriculture, worldwide circa 15% of global food supply is produced in cities (FAO, 2010). According to research, cities have enormous potential to increase their food production: they have available land (e.g. vacant lots, rooftops, parks and backyards); and urbanites demonstrate a growing interest in urban agriculture (Deelstra and Girardet, 2000; Dixon *et al.,* 2009; FAO, 2010). Urban agriculture's multifunctional character has many benefits for cities, including: improving access to healthy food, creating a sense of place, supporting community revitalization, complementing environmental or health education, improving green space and utilising vacant land (Bent *et al.,* 2012; Cohen and Reynolds, 2014; Dixon *et al.,* 2009; Sonnino, 2009; Thibert, 2012). It can also serve as an urban climate strategy (de Zeeuw, 2011; FAO, 2010). However few cities view it as such.

5.2.3 Climate Change and Urban Food Systems

At national and international levels, the relationship between the modern food system (e.g. industrial agriculture, food processing, distribution, consumption) and climate change (mitigation and adaptation) is well established in academic and policy debates (FAO, 2010; IPCC, 2014b). Concerning mitigation, the food system produces between one-third and one-quarter of global GHG emissions from land use change, fossil fuel consumption (e.g. agrochemicals, crude oil in farm equipment, energy for processing, packaging, transport and refrigeration) and methane releases from animal husbandry and food waste (Deelstra and Girardet, 2000; Gilbert, 2012; IPCC, 2014b). Food waste is a growing problem; circa one-third of edible foodstuffs are currently wasted (FAO, 2013).

Concerning adaptation, industrial agriculture is increasingly vulnerable to climate change due to changes in temperature and precipitation, extreme weather and pest

migration which can decimate certain crops, making monocropping particularly vulnerable (FAO, 2010). Globally, agriculture is expected to decline between 3-16% by 2080 from climate change (Cline, 2007; FAO, 2009). Climate change is predicted to impact the agricultural sector more significantly from 2030 onwards, with productivity dropping circa 2% per decade (Bullis, 2014). Additionally, extreme weather and lower precipitation levels make transporting food over long distances more vulnerable (e.g. road/ rail washouts, low rivers, port damages) disrupting food distribution and leading to greater food insecurity and rising prices (FAO, 2010; Schmidhuber *et al.*, 2007).

Both contributions to, and vulnerabilities from, climate change on agriculture at national and international levels manifest at the local level where food consumption takes place. As a result, this relationship between food systems and climate change is increasingly understood as an urban policy concern. In this perspective, we perceive urban food strategies and organic[67] urban agriculture as contributing to a city's climate strategies, addressing mitigation (e.g. reducing transport) and adaptation (e.g. ensuring urban green space, food security) (de Zeeuw, 2011). See Table 5-1.

As cities are viewed as a platform to address climate change, they need to adopt strategies that integrate mitigation and adaptation, facilitating more efficient use of urban services and natural resources while providing co-benefits such as tackling urban vulnerabilities (Hamin and Gurran, 2012; Lenhart *et al.,* 2014; Wilbanks and Sathaye, 2007; Wilson and Piper, 2011). Many cities already incorporate urban greening, which benefits mitigation and adaptation (e.g. mitigating UHIs, supporting unban cooling, facilitating hydrological cycles) (Gill *et al.,* 2007; Hamin and Gurran, 2012; Kleerekoper *et al.,* 2012). Urban agriculture could also offer this, while supporting food security, improved social cohesion and economic benefits (Thibert, 2012; Sonnino, 2009).

Local authorities are primarily tasked to develop and implement integrative urban climate strategies, coordinating between sectors and consulting local businesses, NGOs and civil society (Bulkeley and Castán-Broto 2013, Lenhart *et al.* 2014, UN-Habitat 2011). They are responsible for urban planning and design, including transportation, buildings, infrastructure and green spaces – all sectors crucial for mitigation and adaptation (Howard 2009, Lenhart *et al.* 2014, Wilson and Piper 2011). These sectors also influence integration of local food production within cities.

67 We refer to organic urban agriculture; agrochemical mismanagement can lead to additional emissions, nullifying climate benefits (re: carbon sequestration, local food production) (Cameron *et al.* 2012).

Table 5-1 Urban Agriculture's Mitigation and Adaptation Benefits[68]

Urban Agriculture's Mitigation Benefits	Urban Agriculture's Adaptation Benefits
• Reducing food transportation over long distances, via local food production; • Sequestering carbon, via preserving urban green space and revitalizing derelict land; • Preventing urban sprawl, via preservation of farmland and forests in a city's periphery; • Closing cycles via waste reduction and water/ nutrient recycling (e.g. food waste for compost, rain or grey water for irrigation); • Revitalizing urban soils (better able to sequester carbon), via crop rotation, adopting specific farming techniques (e.g. permaculture) or compost applications; • Increasing fruit and vegetables intake versus more energy intensive and unhealthy food alternatives; • Enhancing the understanding of seasonal variation of food crops and the efforts required for growing food, thereby influencing food waste behaviour.	• Reducing UHI effect and improving a city's microclimate, via preserving urban green space or revitalizing derelict land and facilitating evaporation/ transpiration from vegetation (e.g. fruit trees); • Improving water perforation and reducing urban flooding, via preserving urban green space and revitalizing derelict land; • Maintaining hydrological cycles and ground water access, via preserving urban green space and revitalizing derelict land; • Improving food security, via local food production – also supportive to disaster management (e.g. food availability); • Preparing for/mitigating disaster, via agriculture incorporation along riverbeds or hillsides, thus deterring informal settlements in disaster-prone areas.

If food systems would become a legitimate part of cities' long-term climate/ sustainable development agenda, than urban agriculture could offer an important contribution and should be included within a city's food strategy and integrated within its comprehensive long-term plan (Thibert, 2012). Similar to urban climate strategies, research has found that local authorities (in particular planning authorities) play an important role to weave urban agriculture into a city's urban fabric and planning policies (Morgan, 2009). Moreover, planners are trained to evaluate the connections between sectors (e.g. transport, land use/ green space planning); in this perspective they could integrate urban agriculture into both planning theory and practice (Thibert, 2012). Urban planners though, are not the only actors to consider. Alliances need to be built between local governing authorities with citizens and community groups who initiate and maintain urban agricultural initiatives (Morgan, 2009). To sufficiently anchor urban agriculture requires top-down support from local authorities, as well as bottom-up civil society engagement and ownership (Barthel *et al.,* 2013; Bent *et al.,* 2012; Vermeulen, 2013). Local authorities can support urban agriculture via: facilitating

68 Sources e.g.: Alaimo *et al.,* 2008; Deelstra and Girardet, 2000; Dixon *et al.,* 2009; Gill *et al.,* 2007; Hamin and Gurran, 2012; Kleerekoper *et al.,* 2012; Pothukuchi and Kaufman, 1999.

land tenure and long-term affordable leases, integrating spaces for urban agriculture in planning policy or improving zoning, providing grants for tools and training, coordinating and mapping urban agricultural initiatives, and encouraging public procurement, catering companies and consumers to opt for healthy and local food (Moragues *et al.,* 2013, Vermeulen, 2013; Thibert, 2012). Citizens and communities can engage in urban agriculture via organising and maintaining urban agricultural initiatives by incorporating new or existing skills, knowledge and resources, and building and sustaining a network of committed volunteers (Barthel *et al.,* 2013; Bent *et al.,* 2012). In this regard, we examine how urban agricultural initiatives with top-down support from local authorities (e.g. urban food strategies, planning) and bottom-up engagement from communities (e.g. urban agriculture, local food actions) could contribute – explicitly or implicitly – to a city's broader mitigation and adaptation strategies (see Figure 5-1).

5.3 Urban Food Systems and Climate Change: Examining Amsterdam

Amsterdam is the capital and largest city in the Netherlands with over 800,000 inhabitants. For centuries, it served as the "granary of Europe" on account of its favourable climate, fertile soils, navigable rivers and close proximity to the sea, facilitating food production and food trade[69] (City of Amsterdam, 2013b). Amsterdam remains a food hub: the Netherlands is the second largest international exporter of food and agriculture products (Westerduin, 2014). As a result, food production and food trade influenced its history, economy, geography and recent food policy.

5.3.1 Top-down Support: Amsterdam's Urban Food Strategy

Amsterdam was one of the first European cities to place food systems on the modern urban agenda (Morgan, 2009). Influenced by London's food strategy, Amsterdam's local authority developed an umbrella strategy called *Proeftuin*[70] with initial discussions in 2006. Proeftuin built alliances with public and private food actors (e.g. NGOs, schools, farmer associations, agricultural firms) in North Holland, with neighbouring Zaanstad municipality, with the Dutch Ministry of Agriculture, Nature and Food, and with European networks (e.g. *Peri-Urban PLatform Europe*). Proeftuin (operation: 2008-2010) promoted healthy diets, supported sustainable regional food chains, and developed new urban-rural relations. For example, many schools now have access

69 The food trade influenced Amsterdam's historic and current urban design. Herring was inspected on *Haringpakkerssteeg* (near the old harbour) while cows sauntered in on *Kalverstraat* (now a shopping street) to be sold at the market. Both streets are still located in the city centre.

70 *Proef* means taste; *tuin* means garden. *Proeftuin* means field of experiment, emphasising learning.

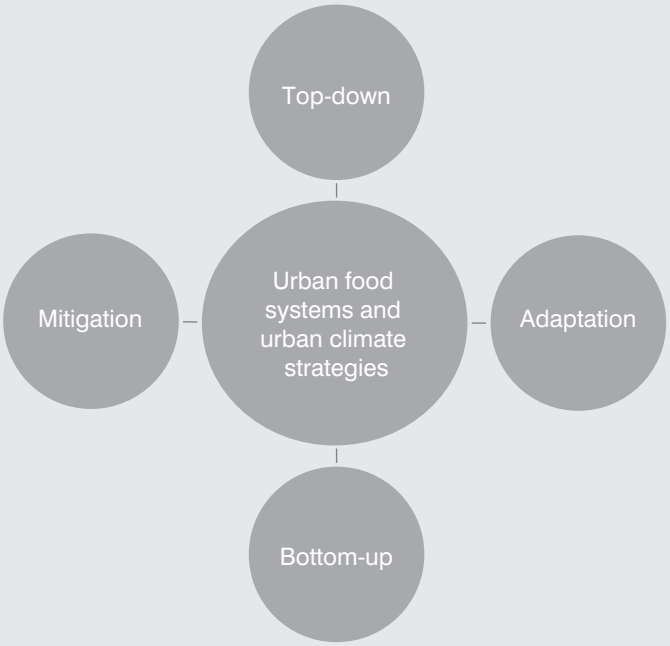

Figure 5-1 The Relationship between Urban Food Strategies, Urban Agriculture and Urban Climate Strategies

to a garden where children learn about food production and healthy consumption by growing and later cooking their own food.

Building on Proeftuin, discussions for a more formal *Amsterdam Food Vision* (Dutch: *Voedsel en Amsterdam*) emerged. The drafting process was participatory in nature, building on formal and informal meetings. Firstly, a project group of circa 120 participants (from the local authority, private sector and civil society) met twice in May 2013 in formal networking events to draft the Vision's main objectives; this led to a smaller focus group of circa 20 persons to discuss the Vision's details. This followed by formal consultation with the mayor and board of aldermen (city councillors). Formalised in December 2013 by the local authority, the Vision's motivations include: health (e.g. diet, obesity), economic considerations (e.g. employment in Amsterdam's food sector), environmental challenges (e.g. shift towards regional and plant-based consumption), education and participation (e.g. healthy choices, food production, resource-waste cycles). A series of agenda items (Table 5-2) support the Vision's rollout of a more sustainable urban food system.

Table 5-2 Amsterdam Food Vision Agenda Items

Local Authority (LA) to support urban agriculture (UA) via:	LA to promote health and sustainable food alternatives via:	LA to support nutrient recycling and closing cycles via:	LA to promote knowledge and exchange on food via:
• Find suitable land; • Provide information on permits and zoning; • Provide a Food Information Point; • Launch a website to help UA actors find each other; • Bid for "Floride 2022" and feature Amsterdam's UA.	• Ensure access to healthy food (e.g. canteens, municipal institutions); • Increase awareness, notably for youth; • Connect initiatives (e.g. school gardens, cooking classes, farm education) for resource streamlining and consistency • Support "Flexitarian" Covenant (i.e. non-meat options).	• Address sectors (e.g. hospitality, healthcare, events) encouraging an increase in regional food consumption and plant-based alternatives; • Recycle food waste; • Encourage less and cleaner transport.	• Cluster food and flower sectors; • Partner with neighbouring municipalities; • Consult industry and academic institutions; • Connect food training and employment; • Support Amsterdam Food Conferences.

The Food Vision recognises that engagement in urban agriculture (especially among youth) can create greater awareness of food systems and lead to more sustainable and healthy food consumption, while supporting the preservation/ maintenance of urban green areas and improving quality of life (City of Amsterdam, 2013b). Additionally, a *Food Information Point* is being established as a central contact for persons and organisations interested in urban agriculture. Until now this is virtual; but discussions are on-going whether a physical centre will be established and what issues it will prioritise. Amsterdam has a web-based map featuring urban agricultural initiatives (see Figure 5-2); a second map features available (municipal and private) land and lease periods. The local authority has a flexible approach to supporting urban agriculture, including: offering limited resources (for workshops,), addressing new zoning and permitting, and supporting pilot projects with initial technical, financial and procedural support. Still challenges facing urban agriculture (e.g. zoning, finding seeds, seeking advice, tax consequences, water rights, engaging committed volunteers) remain; these are acknowledged in the Food Vision. Local food entrepreneurs suggested continued dialogue to address problems as they arise, and a more prominent role for the Food Information Point, such as a physical centre.

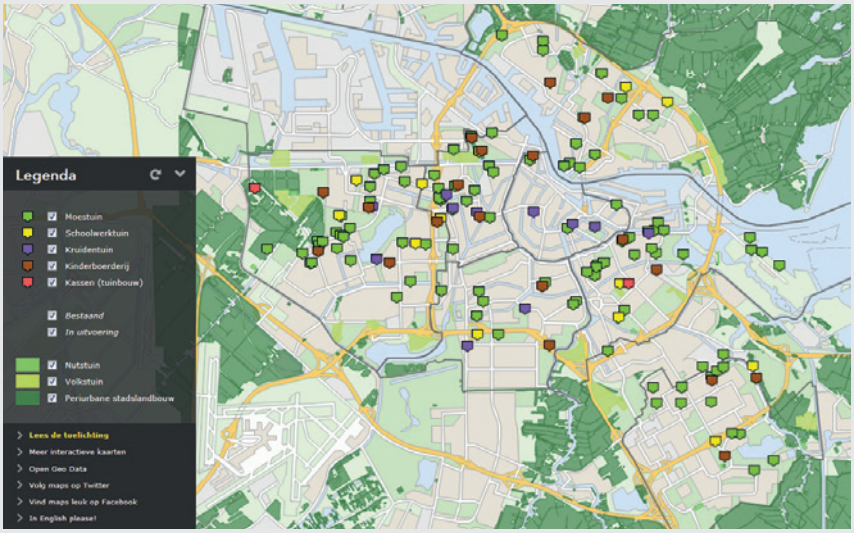

Figure 5-2 Online Map of Urban Agricultural Initiatives in Amsterdam[71]

71 Sourced with permission from City of Amsterdam (http://maps.amsterdam.nl/stadslandbouw/).

Amsterdam's Food Vision is rather comprehensive, addressing large-scale food conglomerates to small-scale urban agriculture, while prioritising local and regional food production and consumption. Because of its broad nature, it faces fragmentation due to competing priorities and interests. Moreover, it lacks political leverage, a dedicated budget and the proper communication procedures. According to a local food NGO, until now it remains "a vision without a concrete policy or dedicated staff" tasked with implementation. Moreover, while an initial budget of 200,000 euros was allocated for 2014, a local authority representative admitted that this is not enough to effectively address all of its ambitions, especially if it intends to further ambitions and implementation over several years. This same interviewee remarked that fragmentation between policy and implementation remains, for example: where can interested urban agriculturalists go for resources to support their gardens (e.g. water rights, equipment); or with whom should they correspond with within the local authority. Moreover, traditionally city district authorities supported their respective urban agricultural initiatives. The Food Vision however was developed by the Spatial Planning Department. While there are benefits to central coordination with distributed management, until now it lacks communication and coordination between the central planning authority and district authorities.

5.3.2 Bottom-up Engagement: Local Food and Urban Agriculture

Amsterdam has an active civil society engaged in discussions on sustainable food, mostly complementing current policy or persuading its continued development. Amsterdam hosts a yearly *Food Film Festival* featuring films and discussions on food sustainability. On-going since 2011, it is jointly supported by several organisations (e.g. Amsterdam local authority, food conglomerates, Wageningen University). Several NGOs and social enterprises (e.g. Youth Food Movement and Food Cabinet) speak out on food waste, organising events and demonstrations. In June 2013, they organised the *Damn Food Waste* campaign: a "food waste lunch" made with food that was too small or damaged for commercial sale. Over 6500 people attended, including the State Secretary of the Ministry of Economic Affairs. Similar food waste lunches later took part in other Dutch cities.

Several organisations specialise in local food production or consumption. *Cityplot* offers workshops on how to grow food in the city (e.g. window gardening, making worm compost) and *Farming the City* hosts food history tours and discusses current policy. Both organisations collaborate, hosting events and workshops to link urban food experts and enthusiasts, such as the 2012 *Urban Farmers Festival* or the 2014 *Amsterdam Food Mash* workshop series; both were organised by several partners, including Noord City District. To support local food consumption, Amsterdam has numerous farmers markets, organic supermarkets and local food restaurants to cater

to the growing interest in local and organic food, or reducing food waste. Amsterdam's expenditure of sustainable food (e.g. organic, local or fair-trade) increased 25% between 2011- 2012, accounting for an increase in total food expenditure from 4.4 to 5.5% while consumption of conventional foods decreased by 0.3% (City of Amsterdam, 2013b).

Amsterdam has over 70 different public urban agricultural initiatives, varying in size and function, producing vegetables, herbs, flowers, mushrooms, as well as fish farming and chicken rearing (City of Amsterdam, 2013b). Most of these initiatives are non-profit gardens run by individuals, volunteer groups, schools or NGOs; however local food entrepreneurs manage some gardens. Volunteers take the produce home as incentive for their work; with small businesses and restaurants selling their produce. These gardens are located in public spaces, in schoolyards, in apartment courtyards, in community allotments, on rooftops, or in container boxes (to avoid possible contamination) on former industrial land. Urban agriculture is gaining in popularity: 13 of the 15 gardens[72] visited during this study were less than five years old. The volunteer base is varied, consisting of native Dutch residents, immigrant families and expats, academics, artists, activists and entrepreneurs, as well as unemployed persons. After visiting 15 gardens and regularly volunteering in two of them, we observed that more than half of urban agricultural volunteers are women. While no formal study in Amsterdam has verified this, similar findings are reflected in New York City, where a popular study found 60- 80% of urban agriculturalists to be women (Tortorello, 2014). In a short survey among urban agricultural volunteers, most stated that they are interested to learn about food cycles and growing techniques, meet a like-minded community, spend time in (urban) nature, address health (e.g. benefits of fresh or organic food), know where their food is coming from and tangibly address environmental issues (e.g. seed patents, food transport). When discussions on the link between climate change and local food production arose between several groups of urban agricultural volunteers (in several different gardens), more than half agreed that local organic food can help combat climate change; few however mentioned it as a primary incentive for engagement.

5.3.3 Urban Food Systems and Climate Change Mitigation Priorities

While not explicitly mentioning climate change, the Food Vision discusses components of common mitigation strategies, including: excessive meat consumption, moving towards a more plant-based diet to reduce GHG emissions, and suggests doing so in schools and catering facilities, such as through Amsterdam's *Flexitarian Covenant* (i.e. availability of vegetarian options) (see Table 5-3). It acknowledges economic and

72 There is an observed distinction between urban agriculture and traditional allotment gardens; the former has a more diverse volunteer base, the latter dominated by older Dutch gardeners.

environmental losses from food waste, and suggests, for instance, campaigns on food waste and food composting. It also acknowledges transport-related GHG emissions, and suggests moving towards more regional food production and consumption, using clean and efficient transportation. Regarding urban agriculture, the Food Vision suggests improved zoning and land allocation (e.g. urban agriculture in temporary spaces, rooftops or vacant lots). It recognises that urban agriculture can support urban greening, and underscores its role in schoolyards to promote local food production and healthy eating habits[73]. The Food Vision also suggests preserving green spaces and farmland around Amsterdam for recreation, food production and limiting urban sprawl.

All of the above have distinct mitigation benefits. However, mitigation is not formerly mentioned in the Vision's text. According to a local authority representative, this will remain, at least in the near term, because different departments and their sub-divisions operate from the perspective of their core business and are not mandated to integrate problems. With limited time and resources, this perpetuates "silo thinking" and influences the framing of policymaking procedures. Thus while addressing food systems is a multi-sectoral issue, and climate change is a multi-sectoral problem, until now these are not integrated in policy.

In addition to the Food Vision, Amsterdam has several strategies that address the urban food system, while explicitly or implicitly addressing mitigation. The *Structural Vision 2010- 2040* (City of Amsterdam, 2011b) states that Amsterdam will prioritise densification of the urban core to meet new growth needs while preserving urban green space; simultaneously it aims to protect the urban periphery for farming and recreation and deter urban sprawl. *The Sustainability Programme* (City of Amsterdam, 2011a) discusses the regional food supply and optimising urban distribution, pointing to school gardens to promote more sustainable food consumption. Both strategies explicitly mention addressing climate change (mitigation and adaptation) within different urban planning and policy strategies.

According to discussions with local food actors and urban agricultural volunteers, climate mitigation is not a primary incentive for engagement. They did however express concerns regarding climate-relevant topics (e.g. food waste, food distribution, and loss of farmland, forests and soil fertility) and the need to close the gap between food production and consumption, including via urban agriculture. Similarly, urban agricultural volunteers expressed a heighted awareness regarding the time and

73 Previous research found that persons who engage with urban agriculture are more likely to eat fruits and vegetables and less likely to eat less healthy – more energy intensive – food products (e.g. sweets, snacks) (Alaimo *et al.,* 2008; Dixon *et al.,* 2009).

energy required for food production, stating that working in a garden has influenced their food purchasing and food waste[74] behaviour. While admitting that they already opt for local and organic products, urban agriculture reaffirms this.

5.3.4 Urban Food Systems and Climate Adaptation Priorities

Like mitigation, the Amsterdam Food Vision does not explicitly mention adaptation, however it implicitly addresses urban adaptation goals within its priorities (see Table 5-3). The Food Vision emphasises inclusion of urban agriculture and urban green space on derelict lands, on rooftops, in backyards, in temporary spaces and in green belts on the urban periphery. In addition to local food production, urban green spaces can reduce UHI or support water perforation, thereby alleviating urban flooding from storm surges (Gill *et al.,* 2009; Hamin and Gurran, 2012). The Food Vision also emphasises local and regional food production and consumption, in particular how school gardens can teach children and communities about local food production, thereby reducing vulnerability to climate-related disruptions in global food distribution (e.g. pest migration, drought) and increasing resilience through knowledge of how to produce food locally (FAO, 2010; Barthel *et al.,* 2013).

In addition to the Food Vision, several strategies address the urban food system, and explicitly or implicitly address adaptation. The Structural Vision and the Sustainability Programme highlight green space and suggest developing a regional food supply – important for mitigation and adaptation, to reduce vulnerability by ensuring green and resilient urban environments. Amsterdam also has a *Rainproof Strategy* (City of Amsterdam, 2013a) that examines how to manage extreme precipitation. It suggests measures such as green roofs and porous pavement, while recognising these are difficult to implement and costly; it proposes tailor-made and interconnected solutions at neighbourhood, street or garden level. While not mentioned in the Rainproof Strategy, urban agriculture (on roofs, in courtyards or backyards, on derelict lands) could offer such a tailor-made, cost-effective and community-managed greening strategy, which in addition to food production can mitigate flash flooding or storm surge impacts (Deelstra and Girardet, 2000). Amsterdam was also part of a Europe-wide project on urban adaptation: *Green and Blue Space Adaptation for Urban Areas and Eco Towns* (GRaBS.eu). Urban agriculture was not discussed; however GRaBS highlights green/ blue spaces to manage a changing climate. It suggested integrating green infrastructure and adaptation planning in urban planning policies, while underscoring community engagement for urban greening. GRaBS focussed on Amsterdam's Nieuw-West district, now an active district in urban agriculture.

74 Even if food is wasted, it still is produced, prepared and transported, using fossil fuels.

Table 5-3 Linking Urban Food Strategies and Urban Agriculture to Urban Climate Strategy Priorities

Top Down

Mitigation		Adaptation
Policies and attributes supportive for urban climate mitigation • *Supportive strategies*: Amsterdam Food Vision, Amsterdam Sustainability Programme, Structural Vision 2010- 2040 • *Physical planning*: safeguard green space in the urban area and periphery for farming and recreation, zoning for urban agriculture. • *Procurement and consumption*: purchase regional/ organic food in municipal institutions, and promote in restaurants, shops and events. • *Education and communication*: connect production and consumption (e.g. school gardens, farm tours, cooking classes); promote plant-based diet, limit food waste and urge composting.	*Policies and attributes supportive for urban climate adaptation* • *Supportive strategies:* Amsterdam Food Vision, Amsterdam Sustainability Programme, Amsterdam Rainproof, GRaBS demonstration project • *Physical planning*: encourage urban greening (e.g. roofs, vacant lots, flexible land leases) for UHI, water perforation and to protect existing green spaces. • *Procurement and consumption*: focus on regional consumption, reducing external vulnerability. • *Education and communication*: teach kids about how to grow food (e.g. school gardens) and improve coordination and communication between different actors.
Citizen engagement in urban agriculture – mitigation benefits listed • *Physical measures*: composting, revitalizing urban soils, improving green spaces. • *Local food provision*: link local food production and consumption, reduce transport and increase local variability. • *Knowledge and learning*: learn from fellow gardeners or via workshops (e.g. grafting fruit trees) on how to grow food, understand food cycles and the consequences of food waste. • *Communication*: work with/ learn from other gardens regarding growing techniques (e.g. crop choices, productivity).	*Citizens engagement in urban agriculture – adaptation benefits listed* • *Physical measures*: creatively add green space (e.g. rooftops, backyards, raised beds), harvest rainwater (e.g. reduce impacts from intensive rainstorms, save water). • *Local food provision*: access and variety of local foodstuffs, reduced dependency on outside sources. • *Knowledge and learning*: learn about local/ indigenous crops species or more climate change resilient varieties. • *Communication*: build a community or gardeners for social resilience.

Bottom Up

Local food NGOs and urban agricultural volunteers also indicate that climate adaptation is not a primary incentive for engagement. Many are unaware of what constitutes an appropriate urban adaptation strategy. They do however express concerns on: global food system vulnerabilities, loss of urban green space and the benefits of local production for resilience. Engagement in urban agriculture also demonstrates the severity of changing climates. Several volunteers indicated that their garden became waterlogged after an intense rainstorm in July 2014 that destroyed sensitive crops and damaged others. This supposedly "once in five year storm" tangibly demonstrated the impacts of more extreme weather. While adaptation was not an initial reason for engagement, the impacts of extreme weather led to discussions about future climate change consequences. Volunteers suggested learning about and planting more climate-resilient crops and other measures to climate-proof the garden.

From policy documents and interviews, it can be concluded that the link between cities, food systems and climate change (mitigation and adaptation) is generally not made explicit and a need for better integration, coordination and cross-sectoral policymaking remains. The reasons for this are discussed in the next section. Still, the Food Vision and other strategies implicitly address mitigation or adaptation goals (see Table 5-3). This was confirmed during interviews and discussions with policymakers, local food actors, and volunteers.

5.4 Discussion

We examined Amsterdam's urban food strategy, the *Amsterdam Food Vision*, and urban agricultural initiatives, in particular how top-down and bottom-up efforts to facilitate a sustainable urban food system could support urban climate strategies on mitigation and adaptation. Three points merit our attention: (1) the framing of urban food strategies and urban agriculture within urban climate strategy; (2) the need for bottom-up and top-down approaches to address urban food strategies and urban agriculture, and climate change; and (3) possibilities to link urban agriculture to climate communication.

Firstly, despite the benefits of urban food strategies and urban agriculture to support urban climate goals, few cities frame urban food systems, in particular urban agriculture, as a climate change issue or make this connection explicit in their policy. This is the case in Amsterdam: its Food Vision discusses many climate-relevant goals; but climate change is not specifically mentioned. Climate mitigation and adaptation are addressed in other strategies; however these make little mention of food systems.

Some cities more explicitly identify the connection between urban food strategies and climate change; we examined two of those cities: London and Malmö. London was one of the first large European cities to adopt an urban food strategy in 2006, which influenced Amsterdam's urban food strategy (Morgan, 2009). London's urban food strategy addresses: improving health, reducing environmental impacts, supporting a vibrant food economy, celebrating cultural diversity and enhancing food security (City of London, 2007). Yearly progress reports assess London's boroughs on local food production, school food, fair-trade food, animal welfare and healthy catering. Concerning climate change, the H*ealthy and Sustainable Food for London* (2007) recognises how urban food consumption contributes to climate change and works across sectors and departments to address the impacts (and opportunities) of urban food systems.

Malmö first adopted a *Climate and Food* focus in 2004, targeting schools and catering facilities, while aiming at 100% organic food in all public procurement (by 2012). To do so, Malmö adopted the *Eat SMART* model: Small amounts of meat; Minimise intake of junk food/ empty calories; An increase in organic; Right sort of meat and vegetables; and Transport efficiency (City of Malmö, 2010b). Concerning climate change, *Malmö's Policy for Sustainable Development and Food* (2010) states, "GHG emissions related to food shall decrease 40% by 2020, compared to 2002 levels." In the Malmö and London strategies, the link between urban food strategies and climate change is explicit. Still, neither strategy identifies urban agriculture as a means to address climate change. While both cities are active in urban agriculture, their food strategies make little outward mention of it. Conversely Amsterdam's urban food strategy, while not explicitly addressing climate change, places greater emphasis on urban agriculture's contribution to urban food systems (and other urban agenda items: public health, green space) and identifies how the local authority can better support integration of urban agriculture.

While each strategy has notable components, we suggest a more explicit link between urban food strategies/ urban agriculture and climate change, identifying how local authorities, citizens and other actors can engage and contribute. We see several benefits for this. As cities are viewed as an appropriate platform to address climate change, they need to seek innovative strategies to address mitigation and adaptation or build synergies between them (Lenhart *et al.,* 2014; Hamin and Gurran, 2012). Urban agriculture offers this: it could be added to a city's climate change toolkit to promote community-managed urban greening, improve local resilience by increasing local food sources, or encourage participation. Similarly, by linking urban food strategies/ urban agriculture to climate goals, local governments could apply to national, EU or international climate finance which target local action. (Interviewees

admitted that until now there is a lack of dedicated resources to implement Amsterdam's Food Vision.)

Secondly, in the literature and in our study we found that urban agriculture depends on bottom-up engagement and top-down support (APA, 2011; Bendt, *et al.,* 2013). In Amsterdam, urban agriculture is largely citizen-driven; this is also the case in Berlin, New York or Malmö (Bendt *et al.,* 2013; Cohen and Reynolds, 2014; Moragues *et al*., 2013). While formerly urban agriculture was often initiated by "subversive citizens" who would occupy and plant abandoned lots – with or without permission – recently, local authorities and urban agriculturalists work more collaboratively, recognising urban agriculture's mutual benefits (e.g. green space, nutrition, water management) (Deelstra and Girardet, 2000; Morgan, 2009). In Amsterdam, local authority representatives and local food actors acknowledge each other's contribution and benefits: local authorities can provide coordination and legitimacy, or use their planning powers to allocate space for urban agriculture; citizens can find creative or cost effective ways to manage urban agriculture or recruit volunteers. Still fragmentation remains between these two groups (e.g. how to prioritise different objectives in the Food Vision, or on competing uses for urban land), indicating that continued dialogue is needed to support urban agriculture and the Food Vision's goals. Some local authorities encourage urban agriculture. In Malmö, new city developments are planned "food growing friendly" and financial support is provided to community gardens in disadvantaged areas (Moragues *et al.,* 2013). Nonetheless, while a local authority may encourage urban agriculture, it depends on bottom-up engagement – or better, a hybrid top-down/ bottom-up supportive structure.

Within most climate-relevant urban sectors local authorities are recognised as important players; however they have limited capacity, and need to work with citizens and stakeholders to implement climate strategies (Revi *et al.,* 2014; Bulkeley and Castán-Broto, 2013; Lenhart *et al.,* 2014; UN-Habitat, 2011). Satterthwaite (2014) suggests collaborative climate strategies, wherein local authorities work with citizens and stakeholders on innovative methods to address climate change. He proposes local authorities move towards a facilitator role, providing a framework for urban climate strategies consisting of regulations, incentives and management, wherein citizens and stakeholders contribute. Looking at Amsterdam's urban food strategy through this lens, the local authority developed the *framework* (i.e. Amsterdam Food Vision) in partnership with key stakeholders; they provide the *regulations* (e.g. on water, land tenure); they provide the *incentives* (e.g. support for workshops and tools, school gardens investments, platforms for stakeholder engagement, pilot projects); and they provide the *management* (e.g. Food Information Point, urban agriculture mapping). Meanwhile, citizens and local food actors devise innovative strategies to

improve the sustainability of urban food systems (e.g. food bank gardens, food waste restaurants).

This combination of top-down support and bottom-up engagement is beneficial for other urban climate strategies that require supportive local policy, while also activating people to engage in environmental/ climate-friendly behaviours (UN-Habitat, 2011; Ockwell *et al.,* 2009). This includes transport strategies that encourage public transport or cycling – but depend on citizen use of buses or bicycles (McKenzie-Mohr and Smith, 1999). Waste management strategies may promote recycling or composting – but depend on citizen waste separation behaviour (McKenzie-Mohr and Smith, 1999). Many of these climate strategies are based on passive participation; local governments design policies and citizens adopt predefined behaviours. Conversely, urban agriculture requires active participation and consistent engagement (e.g. tilling soil, planting seeds, weeding, watering, harvesting) consequently generating ownership (Rosol, 2010). Seymoar *et al.* (2011) suggest a role for citizens and community groups to manage urban green space, while learning about the role of urban greening/ urban planning for climate strategies. Urban agriculture could offer this, demonstrating how citizens can engage in urban climate strategies, while receiving additional benefits: access to healthy foods, outdoor recreation and new community relations. Such additional benefits are not limited to urban agriculture. Choosing to ride a bike can save money, provide exercise or result in cleaner urban air quality (UN-Habitat, 2011). Climate strategies should seek multiple co-benefits – especially if they require citizen/ stakeholder engagement (Ockwell *et al*., 2009; Wilbanks and Sahtaye, 2007).

Thirdly, since climate change is a complex concept to articulate, climate communication strategies should seek methods to make complex topics more tangible and less overwhelming, while focussing on social interaction, participation and reciprocal learning (Ockwell *et al.,* 2009). Urban agriculture could offer this: providing a platform for climate communication while demonstrating tangible actions to address climate change. Urban agricultural volunteers already engage in climate-relevant activities and should be made aware of this to demonstrate climate-relevant behaviour is feasible – or even enjoyable. Building support among enthusiastic and engaged audiences (i.e. urban agricultural volunteers, local food activists) could facilitate social diffusion wherein urban agriculture or other climate-relevant behaviour (e.g. energy efficiency, renewable energy generation, cycling) are learned and later adopted by their peers (McKenzie-Mohr and Smith, 1999).

5.5 Conclusion

This paper explored how urban food strategies and urban agriculture initiatives could benefit a city's climate mitigation and adaptation goals. Using Amsterdam as a case study, we examined *Amsterdam's Food Vision* and urban agricultural initiatives, including key stakeholders and their motivations for engaging in local food efforts. In particular, we studied: (1) whether urban food strategies and urban agriculture are relevant for urban climate strategies; and (2) the importance of top-down support from local authorities and bottom-up engagement from citizens and communities concerning urban food strategies/ urban agriculture.

Concerning the first issue, we find urban agriculture relevant as an urban climate strategy in that it supports both mitigation and adaptation (e.g. local food production, green space preservation). However, it is not made relevant as a climate strategy. Climate change is addressed in Amsterdam's other planning strategies. While urban agriculture contributes to urban climate efforts irrespective of whether this connection is made explicit, we suggest making this connection more visible. From a policy point of view, we recommend linking urban food strategies/ urban agriculture to climate strategies for several reasons, as alluded to in the Discussion: urban agriculture could be added to a city's climate strategy toolkit; local authorities could apply for climate finance; or climate communication campaigns could encourage engagement in urban agriculture or other climate-relevant behaviours.

Concerning the second issue, Amsterdam has a strong presence and interest in local food production and consumption from top-down as well as bottom-up. Amsterdam has over 70 urban agricultural initiatives; meanwhile, consumers have access to regional and organic food at numerous farmers' markets, eco-shops and restaurants. This local/ regional food production and consumption emphasis is reaffirmed in Amsterdam's food strategy. Urban agriculture has grown expansively in the last five years: interviews, surveys and observations during garden visits affirm that circa 75% of all of Amsterdam's urban agricultural initiatives commenced after 2010. While some of this is accredited to the economic crisis in that more vacant land became available, much of this is the result of growing support for urban agriculture by the local authority and citizens. Dialogue and collaboration were important for this; for instance local authorities, NGOs and civil society were involved in drafting the Food Vision and collaborate in the delivery of many food-related actions in Amsterdam. Despite progress, some interviewees indicate that fragmentation remains, hindering a greater rollout of urban agriculture. Thus in addition to this dialogue, there is need for placing greater emphasis on the prioritisation of central goals and strategic issues regarding what Amsterdam's Food Vision wants to accomplish, which will also subsequently support the city's urban agricultural initiatives.

6

Conclusion

6. Conclusion

"We're the first generation to feel the impact of climate change and the last generation that can do something about it."

- Washington State Governor Jay Inslee

6.1 Introduction

The previous chapters have examined urban climate governance, placing specific attention on the role of cities as a platform to address climate change mitigation and adaptation. Concerning mitigation, cities are responsible for between 40- 70% of greenhouse gas (GHG) emissions, including activities such as energy consumption and transportation (IEA, 2008; UN-Habitat, 2011). Concerning adaptation, cities are vulnerable to the consequences of climate change, such as infrastructure stresses, flooding and urban heat island (UHI) (IPCC, 2014). Meanwhile, cities are expanding at unprecedented rates, housing more than 50% of global population and still growing (UN-Habitat, 2008). Consequently, the relationship between the rapid growth of cities, combined with cities' contributions to climate change and the resulting consequences felt in cities, are pertinent issues.

Nonetheless, cities are also increasingly viewed in both science and policy circles as places for climate action. This is important, given the failure of nation states to effectively govern climate change in global agreements or by national actions. Cities have proven to be able to act more quickly on climate change than nation-states (Bulkeley and Castán-Broto, 2012). They also offer a suitable scale to address climate change: small enough to implement climate strategies catered to local socioeconomic and geographical realities, while together, in city networks, they are large enough to make a substantial difference (UN-Habitat, 2011; Laukkonen *et al.*, 2009). Moreover, in cities synergies can be sought between mitigation and adaptation, often by incorporating a sustainable development perspective (Klein *et al.,* 2007; Martens *et al.,* 2009). While various stakeholders are engaged in developing and implementing urban climate strategies, local authorities are an important one to consider. They are, at least traditionally, responsible for urban planning and design, which is relevant for climate change mitigation and adaptation (McCormick *et al.,* 2013; Wilson and Piper, 2010). Research has also found that local authorities lead and coordinate the vast majority of urban climate strategies, especially during initial stages (Bulkeley and Castán-Broto, 2012; Mees *et al.*, 2012).

In this dissertation, I examined the role of local authorities in the design, adoption and implementation of urban climate governance strategies. Notably, urban climate governance does not take place in a policy vacuum; it is influenced by higher (vertical) governing authorities, together with (horizontal) stakeholders within and across cities (Bulkeley, 2010). Consequently, the different cases included in this dissertation analyse how forerunning local authorities engage and interact with particular stakeholder groups who collaborate to address climate change in urban areas. This dissertation focussed on forerunning cities, as they are leaders in urban climate governance regarding both mitigation and adaptation. The mitigation and adaptation strategies of forerunning cities are studied through case studies of Malmö, Sweden, and of Amsterdam and Rotterdam, the Netherlands. The conceptual framework of the dissertation focussed on two key aspects used by local authorities to facilitate urban climate governance: *governing capacities* and *governing modes*, as placed within a *multilevel governance framework*. Each case has been designed to offer a partial understanding of the relationship between governing capacities and governing modes with respect to urban climate governance, by analysing the relationships between local authorities and key urban stakeholder groups in climate relevant sectors (e.g. energy, urban planning, agriculture/food).

The main research question of this study: *How do forerunning local authorities govern climate change in a city, and how can their efforts be improved,* was further detailed in three sub-research questions:

- How do forerunning local authorities draw upon capacities, and which governing capacities do they apply, to address climate change in a city?
- What governing modes do forerunning local authorities apply to address climate change?
- How can best practices in urban climate governance be further improved within a particular city and diffused to other cities?

This rest of this chapter answers these research questions and formulates the general conclusions. Section 6.2 formulates key research findings. Section 6.3 discusses the dissertation's theoretical and empirical contributions to the field of unban climate governance. Finally, Section 6.4 addresses areas for further research.

6.2 Key Research Findings

The changing setting of climate change governance, from something addressed at national and international levels, to increasingly something addressed also at the local level and in cities, has placed new emphasis on urban climate governance. The dissertation's review study and three case studies in Chapters 2- 5 analyse the relationships between local authorities and key stakeholders who collaboratively engage in governing climate change in forerunning cities.

6.2.1 Capacities Supporting Urban Climate Governance

This study contributed to our knowledge on how local authorities govern climate change in cities, by examining the potential capacities of local authorities that support urban climate governance. These include:

- a local authority's internal organisational structure and the coordination of its climate strategies;
- the resources and rules available to address climate change;
- the drawing on rules and resources of higher government authorities and of horizontal networks; and
- the drawing on resources of local stakeholders.

Forerunning local authorities do not have a uniform prevailing method on how to coordinate their climate strategies, but display various organisational structures in the coordination of their climate strategies. Nevertheless, certain characteristics pertaining to ***a local authority's organisational structure and how it coordinates its climate strategies*** were identified in the review study and in all three case studies. Firstly, forerunning local authorities organise their climate strategies by combining central coordination of climate strategies (managed by either a climate coordinator or an interdepartmental steering committee – hereafter referred to as the climate core) together with decentralised implementation within and across a local authority's departments and by key stakeholders (Chapters 2, 3). To ensure that different departments properly execute climate strategies, local authorities make use of regular meetings and structured routines to facilitate working across departmental silos – albeit to varying degrees in the different cities and in the sectors examined. These meetings focus on thematic/ sectoral strategies (e.g. energy, sustainable transport, agriculture/ food) as discussed by sectoral experts, as well as how different thematic strategies relate to one another as discussed by a city's climate core. The latter leads to cross-sectoral climate strategies, for example using waste products to produce energy in Malmö or Rotterdam, or supporting food production in planning schemes in Amsterdam. Regular interaction among different city departments (and

local politicians) improves comprehension of the different aspects of a city's climate strategies, ensures that the perspectives and insights of different departments are taken into account, encourages innovation and improves co-ownership (Fitzgerald and Lenhart, 2015). In Malmö, its recent *Environmental Programme* was adopted unanimously across party lines, in part because different city departments and political authorities were involved in its development. Organisational structures which facilitate horizontal working methods with small power differences (e.g. junior and senior staff share responsibility and speak openly) help generate this internal support, creating an atmosphere of open dialogue and collaboration, generating trust, encouraging experimentation and enabling flexible approaches focussed on learning-by-doing – all to find the most effective methods to address urban climate governance. Malmö's Deputy Mayor Anders Rubin stated, "We don't allow anyone not to innovate and we don't say we haven't done this before. Experimentation is essential to our progress" (Fitzgerald and Lenhart, 2015, page 19).

With respect to the ***resources and rules to govern climate change***, the case study cities affirm findings in the urban climate governance literature, including the importance of financial, human and social capital (e.g. Bulkeley, 2010; Fünfgeld, 2010). Local authorities in the three case studies prioritise and allocate dedicated municipal (financial) resources to support the design and delivery of both overarching and sector-specific (e.g. energy, food) climate strategies. In addition to municipal finances, local authorities pursue partnerships and draw upon external finances to co-fund climate strategies (as discussed below). They have the human resources to develop and coordinate implementation of integrated climate strategies, with personnel dispersed across relevant departments (e.g. urban planning, transport, environment) (Chapters 2, 3). Past experiences, projects and events (e.g. Malmö's economic crisis, the *Industrial Ecosystem project*, or INES, in Rotterdam Harbour) also function as resources for enhancing a local authority's knowledge on how complex issues and strategies can be addressed in an integrated way. Jordan and Huitema (2014, 723) indicate that, "policy innovation is more likely when perceived problem pressure is high." In such circumstances, local authorities learn to function as a singular unit, working across departmental silos and with multiple (and multilevel) stakeholders, while developing personal and professional networks, beneficial for future engagements (see Chapters 3, 4). The Malmö study revealed that the ability of local authorities to successfully navigate an economic crisis (balancing immediate challenges with visionary future planning) generates adaptive capacity, useful for addressing climate change. In Rotterdam, INES was credited with laying the groundwork for a later urban symbiosis project in the city, the *Rotterdam Energy Approach and Planning* (REAP) (see Chapter 4). INES encouraged the use of reflexive learning, dialogue, partnership and monitoring in its development and implementation

(Baas, 1998; Baas and Boons, 2004). Local political and civic leadership proved constantly an instrumental resource to transition a city by articulating and promulgating a new city vision (such as in Malmö) or by encouraging innovative and cross-sectoral climate strategies (such as in Rotterdam). The role of strong political leadership to encourage and support local climate strategies is also confirmed in the urban climate governance literature (e.g. Busch and McCormick, 2014; Fitzgerald and Lenhart, 2015; Shaw and Theobold, 2010).

The case studies also illustrate how local authorities take advantage of typical local decision-making powers to implement their climate strategies, such as using their planning powers on municipal land. In Malmö, a planning monopoly dictates that the local authority has the final approval for any building project; likewise when building on municipal land, developers must adhere to stricter-than-normal planning standards (e.g. inclusion of green roofs or green walls, parking spaces for electric vehicles, energy efficiency) before contracts are signed. In addition to what is described in the previous chapters, the case study cities also incorporate traffic calming measures, such as restricting heavy emission vehicles in their city centres, or designating public transport/ bicycle-only lanes, thereby discouraging private vehicles. In Amsterdam the local authority leases public land to civil society for urban sustainability initiatives that strengthen adaptation, such as urban agriculture (see Chapter 5). In Malmö new developments must be planned as "food growing friendly" neighbourhoods (Moragues *et al.,* 2013).

The literature on multilevel governance emphasises ***how local authorities draw upon resources and rules of higher (national and international) authorities***, including via provision of subsidies, legal support or policy guidance (e.g. Baker and Eckerberg, 2007; Bulkeley, 2010). This is found to be only partially evident in the case study cities. The different case studies provide insight in how and to what extent local authorities make use of higher government rules and resources and horizontal networks. While Swedish and Dutch local authorities previously relied heavily on national subsides and regulatory powers to develop and implement urban climate strategies (as evident in all of the case study cities and indicated in previous literature, see: e.g. Baker and Eckerberg, 2007; Gupta *et al.,* 2007), recent austerity measures limit national support. Evidence suggests that local authorities now rely on national (financial) support only to a limited degree. Simultaneously, regardless of the decentralisation measures and policies that have been promulgated in Sweden and the Netherlands, changes in national regulations have sometimes reduced local autonomy of forerunning cities in developing climate policies. For instance, changes to the *Dutch Building Decree* in 2012 mandate that energy efficiency requirements are set nationally, limiting the possibilities of more ambitious local authorities to

develop stricter standards (see Chapter 2). In the Malmö study, it was revealed that in Sweden, energy security is deemed a national interest and local authorities cannot require energy companies to increase their share of renewables beyond national policies. Local authorities of forerunning cities are thus increasingly limited by less ambitious national standards, by legal powers, and by decreasing financial support of higher (especially national) authorities (see Chapters 2 and 3). In the absence of national support, local authorities often join together, lobbying national authorities to redefine policies that influence cities' climate strategy goals, such was the case with the creation of the *U.S. Conference of Mayors Climate Protection Agreement* initiated in 2005 by former Seattle Mayor Greg Nickels (Bulkeley, 2010). Forerunning cities also do this on an individual basis. In Rotterdam, its local authority petitioned national authorities to incorporate district heating within local energy labelling schemes to benefit the rollout of REAP which relies on the use of "waste" energy sources captured and fed into the district heating network. Depending less on national authorities, local authorities increasingly seek support from public-private partnerships or from external foundations (as discussed below).

In the absence of facilitating national rules, resources and support, European regulations and funding have become more significant (Kern and Bulkeley, 2009). The case study cities are involved in multiple EU projects, working with European cities (including with each other) and other partners on joint-climate strategies, on both mitigation and adaptation. Amsterdam and Malmö were partners, for instance, in the *E-Harbours Electric Project* and the *Green and Blue Space Adaptation for Urban Areas and Eco Towns* (GRaBS) project. They are also engaged in multiple national, European and international city networks to lobby for improved representation and support within national, EU and international fora, to promote their climate strategies in a form of city branding and to seek examples from like-minded cities. Literature suggests that city networks are central for inter-city learning and as well as for technical assistance (e.g. Bouteligier, 2012; Granberg and Elander, 2007; Keiner and Kim, 2007). Initially these networks were viewed as networks of "pioneers for pioneers" (Kern and Bulkeley, 2009, page 311) to promote learning and lobbying mainly amongst forerunners. The case study cities, however, increasingly view these networks more as an avenue to promote their expertise with other (non-forerunning) cities and thereby disseminate their best practices, rather than merely for learning from other cities (Chapter 2). City network participation has not disappeared, but it has become more strategic. Rotterdam is a member (and hosts the Secretariat) of the *Connecting Delta Cities*[75] network, using this network to showcase its leadership in climate change adaptation policy and technology. This indicates that there are

75 *Connecting Delta Cities* (CDC) is a network within the broader C40 Cities Network.

both supplying and receiving cities within city networks; the forerunning cities in this study appear to be the former. Amsterdam and Rotterdam are also both "innovator cities" within the *C40 Cities Climate Leadership Group*; their engagement in C40 focuses more on disseminating innovative climate strategies to other cities, rather than as an avenue to learn, develop and implement new climate strategies.

Local authorities also ***draw on the resources of local stakeholders*** to expand their internal capacity. They do so by utilising local stakeholder skills and expertise to reinforce a city's climate change goals by making use of additional manpower, by encouraging certain citizen behaviours, and by exploiting new (financial) resources (Chapters 3-5). Literature and the case studies demonstrate that for a local authority to meet its climate strategy goals, civil society and private sector engagement and ownership are imperative (e.g. Klein and Huq *et al.*, 2007; Huitema *et al.,* 2010). While engaging stakeholders is encouraged, its actual realisation remains largely limited, with varying degrees of success (Huitema *et al.,* 2011). Nonetheless, the case study cities do reveal evidence of stakeholder engagement strategies pursued by local authorities. However the engagement strategies local authorities pursue, and the stakeholder groups they address and involve, vary depending on the topic(s) of a particular climate strategy. For large-scale citywide approaches to address climate change, such as innovative planning or energy strategies, local authorities build public-private partnerships with institutional and R&D actors (e.g. REAP or *Malmö's Building-Living-Dialogue*, discussed below). In Amsterdam, a combination of top-down institutional networks and bottom-up civil society engagement (including volunteer labour) support urban agriculture expansion. For efforts that encourage citizen behaviour, local authorities use communication campaigns and cooperate with civil society organisations. In Malmö, a communication campaign focussed on cycling aimed to find the "most ridiculous car driver" by utilising bright colours, cheeky messages, public concerts and competitions (see Figure 6-1).

When relying on stakeholder resources and engagement, it is also crucial to consider at which point during the development (or implementation) phase of climate strategies that stakeholders are drawn upon. In Malmö, architects and developers were brought into the *Building-Living-Dialogue* process from the start, so that together they could conceive new sustainability standards for neighbourhood construction. All parties remained involved also in its later implementation, resulting in the construction of Malmö's Flagghusen and Fullriggaren neighbourhoods. In Rotterdam, private partners were brought in only during REAP's implementation phase, with the consequence of their general lack of ownership and hesitation, *vis-à-vis* REAP's execution (see Chapter 4). Finally, engaging with external stakeholders may bring in external funds. While not a local stakeholder, the *Clinton Climate Initiative* was instrumental in the

creation of *Rotterdam Climate Initiative* (RCI). Following RCI's development other (local) stakeholders became engaged, providing financial and other support. When non-public actors engage in supporting climate strategies, a degree of externalisation (as labelled in Chapter 2) of climate strategies becomes evident, wherein local authorities relinquish some of their steering powers, for example to outside funders or project implementers.

Figure 6-1 Malmö's No Ridiculous Car Journeys Campaign[76]

In summary, local authorities make use of a combination of the above governing capacities identified in Chapter 1 of this dissertation. However, facing reducing resources, both locally and from higher government, maintaining their forerunner status in urban climate governance depends to a large extent on two capacities: how local authorities organise and coordinate their climate strategies within their administration (including whether or how they emphasise or encourage dialogue and learning within their organisation and with stakeholders) and secondly, how they draw upon the resources of local stakeholders.

76 Photo credit: Jens Lennartsson photography

6.2.2 Governing Modes

Besides governing capacities, local authorities apply different governing modes to address climate change mitigation and adaptation. Following previous studies (e.g. Bulkeley and Kern, 2006; Kern and Alber, 2008) four ideal-typical governing modes can be distinguished, as described in Chapter 1:

- *self-governing*: local authorities as governors of their own activities and consumption;
- *governing through enabling*: local authorities as facilitators;
- *governing by provision*: local authorities as providers; and
- *governing by authority*: local authorities as regulators.

In my empirical research investigating forerunning cities on climate governance, all four governance modes are identified, be it not to the same extent in every city and regarding each climate issue.

The ***self-governing mode*** is evident in all case studies across the respective local authority organisations, especially *vis-à-vis* local authorities' procurement strategies, their internal energy targets and efforts to govern the climate change profile of municipal buildings and infrastructure. In Malmö, the local authority purchases renewable electricity for its municipal buildings and requires that all public buildings incorporate energy efficiency targets. Malmö is aiming for climate-neutrality of its municipal organisation, including of its public procurement, by 2020 (City of Malmö. 2009a). Concerning municipal vehicles, the three case study cities purchase low-emission and electric vehicles for municipal activities[77] including for maintenance vehicles; they also encourage city employees to use bicycles when attending meetings within city limits. Regarding food, Amsterdam has a voluntary policy aiming to increase organic food consumption and meat-free alternatives in municipal canteens and public schools, as part of its food strategy. Malmö has a similar organic food purchasing strategy for city schools; teachers then use this to educate students regarding the connection between food systems and climate change. In Rotterdam, the local authority invests in green roofs on municipal buildings as a climate change adaptation measure. Through such measures, local authorities set examples for other actors in the city, create a market for climate-friendly products and services, and build support among the city constituency for local climate policy.

The forerunning case study cities reveal a strong emphasis on ***governing by enabling*** "to bring stakeholders on board" (Bulkeley and Kern, 2006, p. 2249), including via

77 In 2010, Malmö won the *European Fleet of the Year Award from the Green Fleet Award* for its efforts to make the municipality´s vehicles greener.

partnerships, education and awareness building. In all of the case study cities, the building of and governance through partnerships is evident, especially to draw on the resources of local stakeholders. Notwithstanding the widespread and frequent inclusion of stakeholders, a clear coordination and facilitation role for the local authority remains. Local authorities partner with knowledge institutions, architects and developers in the design and delivery of energy and urban planning strategies (e.g. in Malmo and Rotterdam). They partner with civil society organisations in the rollout of urban agricultural initiatives (e.g. in Amsterdam) or with institutional actors to coordinate citywide climate strategies (e.g. RCI). Local authorities also partner with other local authorities in a larger geographic region, to implement climate strategies that transcend municipal boundaries (see Chapter 2; Kern and Alber, 2008). In Malmö, the local authority collaborates with neighbouring municipalities regarding the construction of a new light-rail link. Sometimes these partnerships extend beyond a city's (or a nation's) limits. Within *Energy Öresund,* Swedish and Danish local authorities partner with each other and with energy companies, aiming to become the first carbon-neutral region in Europe. The case studies reveal that if partnerships are well implemented – especially from an early stage – stakeholders will engage in the co-design and co-management of climate strategies or even contribute resources, including finances, technical expertise and/or (volunteer) labour. Notably, dialogue and partnership are common practices in both the Netherlands and Sweden. The *Dutch Polder Model,* which focuses on consensus-based policymaking, highlights the importance of dialogue to reach decisions. Malmö's *Building-Living-Dialogue* (which was connected to the national dialogue programme) indicates a similar emphasis on dialogue and working together to reach decisions (Smedby and Neij, 2013). Such dialogues however sometimes delay a particular strategy, or result in less ambitious results (see Chapters 3- 4; e.g. Smedby and Neij, 2013). In Malmö, for example, the local authority is engaged in on-going discussions with the energy company E-ON to encourage biogas as a substitute for natural gas; no timeline for conversion has been established, however. Additionally, local authorities utilise training and education to support and enable the adoption of climate strategies or related behaviour of city constituencies. Secondary schools in Malmö work with their counterpart schools in Copenhagen as part of the EU-project Öresund*klassrummet* involving students and teachers in designing new learning processes for a sustainable society. In Rotterdam, the local authority offers trainings and workshops for housing corporations and energy companies tasked with implementing REAP. Local authorities also provide seed funding to support civil society initiatives, such as for urban agriculture in Amsterdam, or community development strategies in Malmö. In all of these activities, local authorities enable other (often non-public) stakeholders to become engaged and involved in climate change mitigation and adaptation, using various resources and strategies.

Local authorities ***govern climate change by provision*** in the case study cities, namely through infrastructure provision. This includes the provision of bicycle lane networks to facilitate cycling (e.g. imperative for Malmö's emphasis on city cycling and clearly evident in the Dutch case study cities) and the allocation of green spaces to support urban agriculture. Infrastructure provision also includes local energy infrastructure, such as investing in state-owned or co-owned district heating networks or smart grids. *Amsterdam Smart City* is a partnership between the local authority, public energy companies and partners to rollout smart energy systems. The provision of district heating networks are found in all of the cities – and are instrumental for REAP's implementation in Rotterdam. In cities where local authorities still engage in energy provisioning, for example as (co-)owner of utility companies or managers of district energy networks, local authorities take on a more dominant role in governing by provision in this sector (Kern and Alber, 2008). A local authority's ability to provide infrastructure is also influenced by its access to resources, including those from higher government. EU project participation has, for example, supported the implementation of charging stations for electric vehicles (e.g. *E-Harbours* in Amsterdam and Malmö) and new methods for urban green and blue spaces inclusion (e.g. GRaBS in Amsterdam and Malmö). Malmö's zero-energy neighbourhood (called *Bo01*) benefited from national subsides (via Sweden's former *Local Investment Programme*) and from European funds to pilot new energy and planning technologies (e.g. on construction, energy, waste management and green space). In Rotterdam, REAP is supported by two EU projects: *Celsius Cities* (on district heating) and MUSIC (*Mitigation in urban areas: solutions for innovative cities*).

With respect to ***governing by authority,*** local authorities in the case study cities see this governing mode as a last resort, at least with respects to climate policy. Previous studies echo similar findings, indicating that while local authorities often have the legal power to govern climate change (e.g. via transport, land use planning or waste management policies) they make limited use of, or even discourage, regulations (Kern and Alber, 2008) This in part because of the negative reactions of some stakeholders (e.g. the conservative attitude of the construction industry) if local authorities go beyond national regulations (Bulkeley and Kern, 2006). The case studies also revealed that governing by regulation is difficult, since policies affecting local climate goals (e.g. energy efficiency standards) are set nationally, limiting the autonomy of more ambitious local authorities to mandate stricter standards – even in countries with decentralised governing structures (Chapters 2-4). Without supportive national legislation or finances, engaging in local climate strategy remains largely a voluntary task (Alber and Kern, 2008). Still, successful examples of governing by regulation do exist, for example congestion charging of vehicles entering London or Stockholm, or mandating the instillation of solar-thermal collectors in Barcelona, via

its *Solar Thermal Ordinance* (Kern and Alber, 2008). Regarding the latter, this led to the diffusion of similar ordinances in over 40 Catalonian local authorities alone (Ekelund and Sigurdson, 2007). Likewise, Basel and Stuttgart have mandated the inclusion of green roofs on new buildings; this has had a positive side effect: the creation of new green roof technologies and new markets for these technologies (Mees *et al.,* 2012). Notwithstanding, instead of direct regulation, local authorities prefer to encourage and enable stakeholders to adopt more stringent standards through collaboration and joint-ownership of climate strategies, rather than through official mandates (as discussed above and witnessed in the case study cities). This may be due in part to the uncertainty, complexity and controversy surrounding climate change, including any consequent attempts to govern it – locally or otherwise. It might also well be that local authorities' cautious use of governing by authority is to some extent specific to the national regulatory styles present in countries like The Netherlands and Sweden. It may very well be specific to the studied forerunning cities – cities with established relationships and existing procedures to engage stakeholders that are preferred to mandating their engagement. Other cities, or forerunning cities in countries with top-down governing structures, are often less hesitant to use regulations to develop or implement urban climate strategies (Mol, 2010; Mol and Zhang, 2011).

While all four governing modes are present, the case studies reveal a clear emphasis on self-governing, and especially on governing by enabling. This aligns with existing studies on governing modes (e.g. Bulkeley and Kern, 2006; Kern and Alber, 2008) and in the wider urban climate governance literature, which indicates that local authorities' actions alone will not suffice (Bulkeley and Castán-Broto, 2012; Klein and Huq *et al.,* 2007; McCormick *et al.,* 2013; Mees *et al.,* 2012). To effectively govern climate change, all stakeholders should be on board and aligned. This includes the actions of large-scale (private) stakeholders, of civil society organisations, as well as of citizens' behavioural choices. While greater stakeholder engagement is vital in order to govern climate change in cities, local authorities remain central in taking the initiative and coordinating climate strategies and encouraging greater stakeholder engagement, involvement and consequent ownership – albeit to varying degrees of success. By utilising all of the different governing modes, local authorities are able to make use of a wider set of local resources, knowledge and expertise to reinforce and achieve their climate goals.

6.2.3 Diffusion and Improvement of Urban Climate Governance

The case study cities have adopted a variety of innovative strategies and governance approaches, together confirming their forerunning status. Besides enacting these strategies and approaches within their own jurisdictions, the best practice strategies and approaches of these forerunning cities are also *diffused* to other cities. At the

same time, these best practices are not the final answer: there is an ongoing need for further improvement in innovative urban climate governance. This section deals with the diffusion and innovation by forerunning cities.

At least four different diffusion mechanisms can be distinguished through which climate governance best practices of forerunning cities find their way to other cities. Firstly, a variety of (local to international) private stakeholders disseminate forerunning climate strategies to other cities, including private-sector companies, civil-society organisations and knowledge institutes. Regarding private sector dissemination, the Sustainable Business Hub in Malmö supports environmental business development and the dissemination of local clean-tech innovations to other Swedish and international cities. Likewise, major multinational companies with branches in forerunning cities communicate their experiences through their networked mother company, in turn supporting diffusion of best practice strategies. For example, national/ international consultancy firms and engineering companies, such as *Arup* and *Siemens*, work with forerunning cities to help develop innovative climate strategies, and to later disseminate these to other cities. They do so by developing tools, such as the joint Arup/RPA/Siemens' *Toolkit for Resilient Cities*, by using indices to rank and compare forerunning cities (e.g. *Siemens Green City Indexes*) and by partnering with funding organisations and foundations (e.g. *Rockefeller Foundation*). In a similar way civil-society organisations disseminate urban best practices through their global networks (such as those of WWF, IUCN, Friends of the Earth) to land in other cities. WWF launched its *We Love Cities* campaign where citizens can learn about existing strategies, vote on recognised forerunner cities and share ideas for new urban climate innovations. WWF selects model cities to serve as *Earth Hour Capitals* of which Malmö was selected in 2011. Knowledge institutes and research networks also disseminate forerunning cities' climate strategies, including via global research networks such as the Urban Climate Change Research Network (UCCRN) based out of Columbia University, as well as national research networks such as the Dutch Knowledge for Climate Network. Finally, formal and social media channels help disseminate innovative city policy or planning strategies, including via the recently launched *Atlantic's CityLab* and *Guardian Cities* websites.

Secondly, local authorities increasingly partner with regional/ provincial authorities, and with neighbouring local authorities, including to develop joint-climate strategies and to diffuse local forerunners' innovative climate (or other urban governance) strategies to their wider metropolitan regions. The review study indicated that regional diffusion was particularly beneficial for smaller cities, as their local authorities generally have fewer financial and human resources or expertise, and lesser means to participate in international networks (Chapter 2). Smaller cities with fewer resources

are moving instead towards regional networks (e.g. *MidPoint-Brabant* in southern Netherlands) or to project-focussed networks (e.g. *Dutch Energy Valley* or *Solar Region Skåne* in southern Sweden) that offer opportunities for concrete learning from best practices (Chapter 2). Smaller cities that work with regional forerunners – especially those with the capacity and experience to participate in and learn from international networks – benefit from these regional forerunners, leading to regional diffusion (Chapter 2). Since cities in a metropolitan region share similar climatic and socioeconomic situations – and would likely pursue similar climate strategies – these smaller cities might benefit more from regional networks as opposed to global ones. Thirdly, diffusion takes place on a national level through public authorities. This study found that national resources (such as subsides for local climate finance) have become more limited than previously indicated (see Baker and Eckerberg, 2007; Gupta *et al.*, 2007). Nonetheless, the case study cities continue to work with national authorities (e.g. via the Dutch *Green Deals,* or the Swedish *Delegation for Sustainable Cities*). They present their results in training sessions, lobby for national legislative changes (e.g. Rotterdam on district energy labelling) and share their climate strategies with other cities via national fora and networks (e.g. Dutch VNG[78] and Swedish SKL[79]; as well as climate specific networks: Dutch *Klimaatverbond* and Swedish *Klimatkommunerna*). In Sweden, the national government and its partners share examples of Swedish forerunner cities (within Sweden and internationally) that pursue "holistic and sustainable urban development" via the *Symbiocity* Concept[80]. Finally, as discussed in previous sections, forerunning cities (including all the case study cities) engage in EU project partnerships and in transnational city networks (e.g. ICLEI, C40). For forerunning cities this is particularly beneficial to further diffuse their climate strategies or innovations across Europe or the globe (see Bouteligier, 2012).

The case studies have also harvested knowledge on the frontiers where urban climate governance in forerunning cities can be further improved. With respect to this dissertation's conceptual framework, which investigated governing capacities and governing modes within the context of a multilevel governance system, the case studies demonstrate three areas for improvement to facilitate the furthering of urban climate governance. Firstly with respect to governing capacities, local authorities – including those in forerunning cities – could make better use of drawing upon the resources of local stakeholders. While increasing and improving stakeholder participation is widely acknowledged and advised in scientific literature and policy documents, our investigations as well as assessments from other literature indicate

78 *Vereniging van Nederlandse Gemeenten* (English: Association of Dutch Municipalities)

79 *Sveriges Kommuner och Landsting* (English: Swedish Association of Local Authorities and Regions)

80 Symbiocity is a partnership between the Swedish National Government, Business Sweden and SKL International. See http://www.symbiocity.org

that doing so adequately and effectively remains a challenge (Huitema *et al.,* 2011). From the case study cities, one can conclude that earlier engagement of stakeholders, perhaps already in the design stage of urban climate strategies, improves their ownership and later implementation records. In Rotterdam, external stakeholders were engaged only after REAP's conceptual design was established; this may be one reason for its limited implementation and dispersal. Nonetheless, local authorities should remain in a coordinating position, in particular during initial phases, without overly relinquishing control to external stakeholders – especially to those with competing priorities (e.g. Bulkeley and Castán-Broto, 2013). In Amsterdam, the design of the urban food strategy encouraged broad stakeholder engagement from the start. While Amsterdam's emphasis on participation is commendable, without setting the initial parameters the food strategy suffered from competing priorities and delaying implementation. In Malmö, after years of learning to balance central control within the local authority and (early) engagement of stakeholders, it has developed a rather consistent method: the local authority sets initial (albeit abstract) goals and parameters, and then engages external stakeholders to decide together how to reach these goals. Malmö has received recognition for its efforts in participatory planning and implementation (e.g. 2010 *World Habitat Award* winner) and continues to employ this approach in designing new neighbourhoods (e.g. the *Building-Living-Dialogue*) and to retrofit existing neighbourhoods (e.g. Ecocity Augustenborg and Rosengård as discussed in Chapter 3). Still, Smedby and Neij (2013, 155) indicate that while Malmö's Dialogue served as a "strong mobiliser for change" it is vital to not just set up a collaboration agreement, but to ensure that the goals set are reached, pointing to several areas (e.g. on energy, green space planning and material use) that did not meet their initial projected goals. They suggest the consolidation of project goals, as well as following such processes up with reporting and evaluations. The latter is consistent with other literature (e.g. Huitema *et al.,* 2011).

Secondly concerning governing modes, the case study cities, supported by existing literature (e.g. Bulkeley and Kern, 2006; Kern and Alber, 2008) suggest that there is greater room for the use of governing by authority. While cities generally prefer to employ governing by enabling regarding climate change, there are instances when governing by authority can be quite effective to employ, alongside the other governing modes. For example, with respect to the transport sector cities like London and Stockholm make use of local regulations (e.g. congestion charging), which result in a rapid and effective application of addressing climate change in a city (see Kern and Alber, 2008 for other regulatory examples). In the case of congestion charging, these measures first met with criticism but later shifted to embracement (Kern and Alber, 2008). It helped that congestion charging did not just address climate change but also led to better urban air quality, reduced city traffic and improved road safety.

Finally, taking a multilevel framework perspective into account, improvement in forerunning cities' climate governance can be furthered through friendly rivalry to "out green" the other. Malmö, for example, constantly compares itself to both Copenhagen and Stockholm pointing out, for example, that it has more green roofs or bicycle lanes than these respective cities. This inability to be comfortable with the climate governance status quo (perhaps in part because of Malmö's little sister city complex) further drives its innovative approaches with respects to climate strategies (Fitzgerald and Lenhart, 2015). Likewise, Rotterdam and Amsterdam compete, for example with each other, on topics including the application of smart grids or efforts to adapt to climate change. In this friendly competition, they also learn from each other. REAP, for example, influenced the creation of a similar strategy called *Amsterdam's Guide to Energetic Urban Planning* [81]. More than just regional competition, forerunning cities with an international outlook also compete with (and learn from) leading global cities. They compete to be the first global city to achieve climate neutrality, climate resiliency or the like, driving further improvement and innovation in urban climate strategies. The competition is fuelled by awards received, (positive) media attention, as well as by the resulting economic benefits (e.g. McCormick *et al.,* 2013).

In summary, due to the complexity and uncertainty of climate change, public actors (especially local authorities) are emerging as crucial players to govern climate change in cities. They do so by making use of their governing capacities and by employing governing modes, within a multilevel governance system. While certain capacities and modes stand out, local authorities cannot rely only on one mode or capacity, in part because of the "wicked nature" of climate change as a policy problem (Jordan *et al.,* 2010; Jordan and Huitema, 2014) and in part because addressing climate change comes with learning and experimenting (e.g. Castán-Broto and Bulkeley, 2012; Fitzgerald and Lenhart, 2015; Huitema *et al.,* 2010). Forerunning local authorities must have their eyes pointed in several directions simultaneously: combining central coordination of climate strategies with strong stakeholder involvement, focussing on long-term visions and short-term implementation, and addressing mitigation and adaptation, often combined with other efforts focussed on sustainable urban development.

81 In Dutch: *Leidraad Energetische Stedenbouw* (http://www.amsterdam.nl/gemeente/organisatie/ruimte-economie/ruimte-duurzaamheid/ruimte-duurzaamheid/les-leidraad/)

6.3 Conceptual and Methodological Reflections

This dissertation contributes to the understanding of urban climate governance, taking an in-depth examination of the role of forerunning local authorities and their interactions with key stakeholders to address climate change in a city. Together the different cases offer insight into the governing capacities and modes that local authorities apply to act on climate change. The duality of governing capacities and governing modes was at the centre of the conceptual framework, as discussed in Chapter 1.4 and depicted in Figure 1-4. In this section, I reflect on the usefulness of this framework and discuss the dissertation's key contributions to the urban climate governance literature in five points. The section concludes with a reflection on the methodological approach.

Firstly, while considerable literature exists on the role of local authorities to address climate change, few studies combine an examination of local authorities' governing capacities with the governing modes used by local authorities to address climate change. The relationship between governing capacities and governing modes, as placed within a multilevel governance perspective, forms this dissertation's conceptual framework and brings to light the roles, actions and capabilities of local authorities to address climate change in cities. The development of this conceptual framework follows Jänicke (1997) and his colleagues at the Freie Universität Berlin (Weidner, 2002; Weidner and Jänicke, 2002; Jacob and Volkery, 2007) who start from the premise that environmental governance (here urban climate governance) depends not only on the choice of policy instrument, but also on the interactions between governing capacity, as a relatively stable condition, and the utilisation of such capacities (here referred to as governing modes) through which urban climate strategies are implemented. Additionally, urban climate governance does not take place in a policy vacuum, but in a multilevel system (what Jänicke *cum suis* often label the structural and institutional context) influenced by vertical and horizontal governing actors and institutions (Bulkeley, 2010). But there are also differences. Where Jänicke and colleagues focus very much on national capacities for environmental governance, this study added to that by concentrating on local capacities and modes of climate governance. Compared to the conceptual model of Jänicke and colleagues, my conceptualisation has reduced complexity by putting (local) public authorities much more central, rather than the entire governance complex. Finally, the conceptual model applied in this dissertation focuses more on analysing capacities (and modes), while Jänicke concentrates on building capacity.

Secondly, the dissertation takes local authorities as its primary unit of analysis to examine the governing of climate change in cities. This is a starting point that to some

extent contradicts the current governance literature with its emphasis (and unit of analysis) on networks and public-private partnerships, rather than on government authorities. To be sure: this study did investigate how local authorities interact with local (horizontal) stakeholders, including civil society and the private sector, as well as how they interact with and are influenced by higher (vertical) governing authorities, namely nation states, the European Union as well as (horizontal) city networks. Examining both horizontal and vertical stakeholders reveals how local authorities influence urban climate governance, and equally how external forces influence them. Exploring these local authority-stakeholder interactions, however, made it apparent that at least in forerunner cities, local authorities have stepped up, taking on a more predominant governing role, largely as a coordinator and enabler, but at times even as a regulator. This feeds into the emerging literature on "bringing the environmental state back in" (e.g. Mol, 2007 and 2015; Jordan and Huitema, 2014; Zito, 2015) Arguably this may not be the case at all (governmental) levels nor regarding all issues. But in urban climate governance though, this is evident. In the case of forerunning cities in climate policy, local authorities serve as the coordinator and facilitator of urban climate strategies, while engaging various stakeholders to make use of their governing capacities, and employing various governing modes to address climate change.

Thirdly, in using this model to analyse urban climate governance, specific relationships between particular modes and capacities are observed. For instance:

- A local authority's internal organisational structure and the coordination of its climate strategies enable its ability to incorporate and make use of self-governing.
- Drawing on the resources of local stakeholders (wherein stakeholders' specific capacities support urban climate strategies) is best aligned with governing by enabling. The case studies indicate that governing by enabling is enhanced when local authorities already have established and healthy contacts with local stakeholders, thereby making use of these resources.
- Similarly, drawing on the rules and resources of higher authorities strengthens local authorities' capability to govern by provision, especially when additional (vertical or horizontal) resources become available to assist local authorities to engage this governing mode (e.g. via infrastructure provision or additional finances).

Hence, while governing capacities and governing modes were presented as separate dimensions in Chapter 1's conceptual framework, in practice urban climate governance in forerunning cities demonstrates that two dimensions prove partly interdependent, in particular ways. There are logical combinations of modes and capacities that emerge in concrete examples of governing climate change by local authorities. More

quantitative research needs to disentangle the frequency and degree of these inter-dependencies in cities' climate governance.

Fourthly, this dissertation examined how local authorities in different case study cities govern climate change by examining several distinct sectors relevant to climate change (e.g. urban planning, energy, food systems). Each case studied the interactions between the local authority (or a department of the local authority) and key stakeholders concerning a particular sectoral climate strategy. The case studies reveal that not every category of stakeholders is equally present/engaged in sectoral climate governance strategies. In the Rotterdam case study on energy in the built environment, institutional and economic stakeholders proved more engaged and included compared to those from civil society. In investigating Amsterdam's urban food strategy and urban agriculture initiatives, especially the latter, the local authority focussed on engaging civil society (although Amsterdam's Food Vision also refers to the role that institutional agri-food companies play for the city's economy and its food provision). Theoretically, one would think that engaging both civil society stakeholders and more economic/market/institutional actors enhances the support and implementation of a local authority's climate governance goals. But this can very well be dependent on the sector, and on the kind of strategy.

Fifthly, this dissertation examines strategies to address mitigation and adaptation, contributing to the understanding of how local authorities can integrate these two faces of climate policy in cities. While the topic of urban climate governance has existed for circa 20 years, most studies focus on either mitigation (Betsill, 2001; Felman and Witt, 1993; Alber *et al.,* 1996; Hoornweg *et al.,* 2011; Kern and Alber, 2008;) or adaptation (e.g. Hodson and Marvin, 2009; Mees *et al.,* 2012). Scholars have called regularly for more integrated climate strategies (Klein and Huq *et al.*, 2007; Martens *et al.*, 2009; Laukkonen *et al.*, 2009). Rarely however, are mitigation and adaptation examined in the same study. This dissertation contributes to filling this gap, investigating elements of common mitigation and adaptation strategies in the different case studies. In doing so, the case studies offer practical examples of how mitigation and adaptation can be addressed jointly in a particular city or sector, and how synergies can be sought between the two. Taking both mitigation and adaptation into account improves policy coherence and reduces negative consequences that result from singular focussed strategies (e.g. resource misallocation, competing priorities). Even in sectors deemed relevant primarily for mitigation or for adaptation, taking a more inclusive approach to both aspects reveals additional benefits. For example, urban greening is beneficial for mitigation and adaptation: green spaces sequester carbon, while enabling perforation of storm water and reducing UHI. The case study cities, and other forerunning cities consulted in this dissertation's literature,

reveal that combining mitigation and adaptation strategies is best done within a city's broader sustainable development strategy or perspective, linking climate policy to other urban policy, such as health or social vulnerabilities (Klein and Huq *et al.,* 2007; Laukkonen *et al.,* 2009).

Given the specific research questions developed in the first chapter, it was logical to aim for an in-depth qualitative case study approach. Methodologically, this dissertation's greatest challenge was to acknowledge the large variety in capacities and modes in distinct cities that aim to address climate change, while at the same time reach sufficient depth by performing in-depth analyses of different case studies as well as different sectors. Chapter 2's review study assisted in this, leading to the selection of two (Dutch) case studies. The three case studies represent in-depth analyses of how local authorities, in relation with stakeholders, address climate change through distinct capacities and governance modes. But it goes without saying that the three case studies, with each having a focus on only one or two sectors in that particular city, cannot be seen as representative of all forerunning cities, and perhaps not even of all forerunning cities in Sweden and the Netherlands regarding all climate relevant sectors. Here we touch upon the limitations of qualitative case study research. What the study has done is to show the usefulness and relevance of a local authority perspective, with regards to the role of capacity and modes in better understanding how forerunning cities govern climate change, and to learn lessons from that for diffusion and improvement. To further generalise these findings and lessons, additional in-depth and comparative case studies, as well as more large-scale quantitative reviews, would be necessary.

6.4 Future Research

This dissertation focussed on urban climate governance in the context of forerunning cities in Northern Europe – the European dimension adding an extra layer to multilevel governance not found in other global regions. From this and following the conceptual framework, five areas for future research are described.

Firstly, many strategies in these forerunning cities are relatively new in addressing climate change. In particular the Rotterdam Energy Approach and Planning, as well as Amsterdam's Food Strategy, are less than five years old. Therefore a longitudinal study, conducted over several years could help to better grasp the full impact and sustainability of these strategies. Doing so could also support these cities' monitoring and evaluation efforts, examining what works and what does not.

Secondly, future research could examine how local authorities utilise governing capacities and governing modes to address climate change in forerunning cities in other world regions, including how multilevel authorities influence these respective global cities. This may differ in a North American or Australian context, with the absence of strong national policy on climate change. Additionally, while cities in these regions have similar access to resources, their rulemaking powers (e.g. municipal land ownership, planning powers) differ. In China, with a more vertical (top-down) governing structure, the combination of governing capacities and modes would likely manifest a different result. While (larger) Chinese cities generally have access to a sufficient amount of both rules and resources, it could be useful to investigate how they engage with stakeholders, as well as which governing modes they employ in order to govern climate change.

Thirdly, it may be interesting to apply a similar conceptual framework to non-forerunning cities, to scrutinize where the differences and gaps lie in how they govern climate strategies. For example, do such cities not make full use of local resources and rules? Or which governing modes do they omit when enacting climate strategies? While the findings of the review study indicate that size (sometimes) matters – in terms of access to resources, expertise or city network participation – smaller cities, especially when supported by strong leadership, can more rapidly deploy certain climate strategies (e.g. Almere's Food Strategy in the Netherlands; Växjö's renewable energy profile in Sweden – albeit neither of these cities is actually that "small" in their national context). A better understanding of gaps of non-forerunning or laggard cities, as well as how they could be circumnavigated, could be beneficial for the wider field of urban climate governance, bringing to light not just what works, but also what does not and why.

Fourthly, the cities in this dissertation are located in a similar climatic zone and benefit from similar socioeconomic conditions. Examining cities located in different climatic zones or cities with fewer socioeconomic resources would likely result in a different prioritisation of (sectoral) climate strategies by their respective local authorities and stakeholder agglomerations that could be worth investigating. For example, which sectoral strategies do cities in the Middle East prioritise, especially given their extreme heat conditions. How (or do) they engage citizens, especially in cultures where public participation, especially among certain groups (e.g. women) is more limited. Some of the more vulnerable cities to climate change are also those who have contributed least to the problem. How do such cities – especially when facing more limited capacity within their local authorities – address climate change? Is stakeholder collaboration, especially with the private sector or international institutions less (or more) common? And what lessons can respective forerunner cities in the Global

South also share with “forerunning” cities of Europe? Some Latin American cities (e.g. Medellín, Colombia) have made rapid and rather remarkable transitions, moving from laggards to leaders with respect to efforts centred on sustainable city governance (and climate change) by making use of citizen-focussed and participatory governance schemes and collaborating with various local and international stakeholders to reinforce their transitions. Bogotá, Colombia, initiated the concept of *Cycling Sundays* to encourage persons to get out of the car and use their public spaces. Curitiba, Brazil launched its *Bus Rapid Transit* system, which has been replicated to multiple cities across Latin America, Asia and elsewhere. Dar es Salaam, Tanzania, was an early forerunner in urban agriculture already for more than 10 years – something European and other Western cities increasingly promote.

Finally a quantitative study could provide a more representative outcome of how local authorities govern climate change, focussing on European cities, or in other regions. This could entail a larger study, of say 40 cities, that examines how local authorities make use of both governing capacities and governing modes. Such a study design would require a further standardisation of governing modes and capacities through measurable indicators.

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Annex 1: Example of Topic List

(Used for interviews on Malmö)

Background

1. How does Malmö prioritise mitigation and adaptation within policies and actions?
   a. Has the city taken an active stance for adaptation?
2. How has (inter)national attention influenced Malmö's efforts to address climate change?
3. What cities does Malmö look to for climate leadership?

Organisational Structure

1. How is climate change organised within Malmö municipality?
   a. Does Malmö have a specific climate strategy/ policy or key strategies?
   b. How and which departments coordinate climate-related activities?
2. Does Malmö's organisational structure facilitate climate actions?
   a. How often are meetings held, within and across departments, on climate change?

Leadership

1. What is Malmö's climate change vision?
2. What role do politicians/ department heads play to address climate change?

Capacity

1. Does Malmö have sufficient time, expertise and resources to tackle climate change?
2. How has the response capacity for mitigation and adaptation differed, or is this similar?

Communication

1. How is climate change 'framed' in Malmö (i.e. as a threat, opportunity, obligation)?
2. How are climate change and sustainable development communicated?
   a. Are climate change and sustainable development linked in Malmö?
   b. What efforts address these issues (e.g. media, promotional materials, activities)?
3. How many persons work on Malmö's climate change strategies?
4. What efforts are directed at Malmö schools?

Participation and enabling

1. How is climate change connected to sustainable development in Malmö?
2. How are citizens, NGOs and companies involved in Malmö's climate activities?
3. What (NGO, private sector, knowledge) platforms exist to enable climate actions?
4. What type of funding is available and for what type of projects?
5. Is public participation a component of sustainability/ climate actions in Malmö?
   a. How is this ensured? Do citizens know how or where to engage?

Vertical and Horizontal Collaboration

1. At the national level, which ministries partner with Malmö on climate change?
   a. What national policies and funding streams support local climate action?
   b. How much money has Malmö received to support its climate change activities?
2. What role has the EU played (e.g. funding/ knowledge) on Malmö's climate action?
3. Which (trans)national networks is Malmö engaged in, and have these been useful?
4. Does Malmö collaborate with neighbouring municipalities and has this proven useful?
5. Does Malmö collaborate with knowledge institutes and has this proven useful?

Annex 2: List of interviewees

Organisation/ Interviewee	Organisation's details/ topics discussed	Stakeholder position	Date and logistics of interview
1. *KlimatKommunera*	Discussion on climate policy in Swedish cities and the role of national city climate networks to support cities	City Network	22 September 2010 In-person interview
2. Malmö Environment Department	Discussion on Malmö's city vision and its *Environmental Programme* with persons working with climate strategy and communication	Local Authority	22 September 2010 Group in-person interview with three interviewees
3. Lund University's International Institute for Industrial Environmental Economics	Discussion on partnership between Lund University and Malmö on joint-research projects pertaining to e.g. energy efficiency in buildings and urban transformations	Knowledge Institute	23 September 2010 Group in-person interview with three interviewees
4. *Servicepunt Duurzame Energie* (support office for sustainable energy) of Noord-Holland Province	Discussion on the *CO2 Service punt* and the role of *Servicepunt Duurzame Energie* to assist local authorities to implement climate strategies and to help communities realise (collective) energy projects	Regional Authority	6 October 2011 In-person interview conducted by MSc student
5. Dutch Ministry of Economic Affairs, Agriculture and Innovation	Discussion on national support for local climate policy in the Netherlands, including changes in subsidy schemes	National Authority	17 October 2011 In-person interview
6. Climate and Energy Advisor, Utrechtse Heuvelrug Municipality	Discussion on the transitions in Dutch urban/ local climate governance, discussed with former WUR researcher, now local authority representative	Local Authority	18 October 2011 Group in-person interview
7. *Klimaatverbond*	Discussion with coordinator of *Klimaatverbond* (Dutch City Network) on the role of national city climate networks to support urban climate strategies	City Network	27 October 2011 Group in-person interview

Organisation/ Interviewee	Organisation's details/ topics discussed	Stakeholder position	Date and logistics of interview
8. Amsterdam Programme Bureau on Climate and Energy	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011[82] Telephone Interview conducted by MSc student
9. Advisor to RCI at the Programme Bureau of Sustainability, Rotterdam Development Department	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
10. Programme Coordinator of Climate Change, Den Haag Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
11. Programme Manager, *Utrechtse Energie*, Utrecht Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
12. Programme Manager of Sustainability, together with Policy Advisor of Blue and Green Planning, Eindhoven Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities, as well as the role of green/ blue spaces planning	Local Authority	November 2011 Telephone Interview conducted by MSc student (with two interviewees)
13. Programme Manager of Climate and Energy, Tilburg Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
14. Energy Planner, Almere Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
15. Policy Advisor, Sustainability, together with Advisor on City Ecology, Groningen Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student (with two interviewees)
16. Senior Advisor, Environment, Breda Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
17. Senior Advisor on Climate and Energy, Nijmegen Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student

18.	Senior Policy Advisor, Enschede Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
19.	Strategic Advisor on Public Space, Apeldoorn Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
20.	Senior Policy Advisor, Haarlem Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
21.	Programme Manager on Climate Change, Zaanstad Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
22.	Programme Manager on Sustainability, Knowledge and Innovation, Haarlemmermeer	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
23.	Coordinator of Energy and Climate, 's-Hertogenbosch Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
24.	Policy Advisor, Environment, Zoetermeer Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
25.	Senior Policy Advisor, Zwolle Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
26.	Senior Policy Advisor, Sustainability, Maastricht Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
27.	Senior Policy Advisor, Energy, Dordrecht Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
28.	Policy Advisor of Development, Leiden Municipality, together with *Milieudienst* West Holland	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student (with two interviewees)

Organisation/ Interviewee	Organisation's details/ topics discussed	Stakeholder position	Date and logistics of interview
29. Policy Advisor of Energy, Climate and Environment, Emmen Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
30. Advisor of Climate Policy, Ede Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
31. Climate Coordinator, Venlo Municipality	Discussion on municipal climate strategies, with regards to the anchoring of mitigation and adaptation activities	Local Authority	November 2011 Telephone Interview conducted by MSc student
32. Malmö City Planning Office, Sustainable City Planning Unit	Discussion on Malmö's Master Plan and the Environment Programme and how these interact with its urban climate strategies	Local Authority	9 January 2012 Interview conducted by MSc student
33. Malmö Streets and Parks Department, Sustainable Transport Unit	Discussion on projects to support sustainable transport strategies in Malmö (and links to climate change)	Local Authority	10 January 2012 Interview conducted by MSc student
34. Malmö Environment Department, Chief: Climate Change Unit	Discussion on relationship between climate and sustainable strategies in Malmö	Local Authority	27 February 2012 Telephone Interview
35. Malmö Environment Department, EU programmes coordinator	Discussion on network engagement and EU projects to support climate change/sustainability strategies	Local Authority	27 February 2012 Email Correspondence
36. Malmö Environment Department, Communications Liaison	Discussion on communication strategies to engage civil society and the private sector	Local Authority	6 March 2012 Telephone Interview
37. Malmö City Planning Office, Liaison of Communications	Discussion on the history of Malmö's transition as well as the city's international profile	Local Authority	8 March 2012 Telephone Interview
38. Malmö Environment Department, Chief of Unit of Sustainable Development	Discussion on strategies to engage and support public participation in climate strategies	Local Authority	8 March 2012 Telephone Interview
39. Malmö Environment Department	Discussion on planning for risks in urban planning projects and the role of learning	Local Authority	12 June 2012 Telephone Interview
40. Wageningen University, researcher on energy	Discussion on REAP and other planning tools to for improved urban resource management	Knowledge Institute	24 July 2012 In-person interview

41.	Amsterdam Spatial Planning Office	Discussion with coordinator of LES on Amsterdam Smart City, EU city networks and REAP's influence in LES	Local Authority	25 August 2012 In-person interview
42.	Spatial Planning Unit, Rotterdam Development Department	Discussion on Rotterdam's energy and climate projects with REAP project coordinator	Local Authority	25 September 2012 In-person interview
43.	Urban Agricultural Project Initiator	Discussion with project initiator and coordinator for *I Can Change the World With My Two Hands* (community garden) and *Access to Tools* (Urban Agricultural Shop)	Civil Society	26 September 2012 In-person interview
44.	Cityplot	Discussion with local NGO on how to engage citizens in local food initiatives and the link between climate change and local food	Civil Society	29 September 2012 Group in-person interview with two interviewees[83]
45.	Urban Agricultural Project Initiator	Discussion with project coordinators for the *Curious Finch Garden*	Civil Society	11 January 2013 Group in-person interview with two interviewees[84]
46.	Rotterdam Engineering Company, Department of Public Works	Discussion with Rotterdam Energy Advisor, tasked with implementing REAP and stakeholder communication	Local Authority	27 March 2013 In-person interview
47.	Doepel Strijkers Architects (interviewee 1)	Urban planner, focus on REAP's future potential in Rotterdam	Private Sector	15 April 2013 Skype interview
48.	Doepel Strijkers Architects (interviewee 2)	Architect, involved in REAP1 energy exchange scenarios and building concepts	Private Sector	19 April 2013 In-person interview
49.	Joubert Architecture	Architect, involved in REAP1 energy exchange scenarios and building concepts	Private Sector	19 April 2013 In-person interview
50.	Urban Agricultural Project Initiator	Discussion with project participants at the Amsterdam *Zuidas Garden*	Civil Society	3 May 2013 In-person interview with three persons
51.	Malmö Environment Department	Discussion of climate strategies under changing political leadership	Local Authority	30 September 2013 In-person interview
52.	Malmö Environment Department	Discussion on Malmö's Food Strategy with two persons	Local Authority	31 May 2013 Group in-person interview with two interviewees

Organisation/ Interviewee	Organisation's details/ topics discussed	Stakeholder position	Date and logistics of interview
53. Wageningen University, researcher on local food	Urban agriculture in Amsterdam	Knowledge Institute	17 March 2013 In-person interview
54. Technical University of Delft, Faculty of Architecture	Member of REAP's initial design team	Knowledge Institute	14 March 2014 In-person interview
55. Development Cooperation Unit, Rotterdam Development Department	Policy Coordinator and REAP Commissioner (on behalf of Rotterdam Climate Initiative)	Local Authority	26 March 2014 In-person interview
56. DWA Engineering	Representative of engineering company and REAP2 partner, focus on district heating/ energy storage	Private Sector	28 March 2014 In-person interview
57. School Teacher, in an Afterschool Programme, Amsterdam District Noord	Discussion on Amsterdam school gardens, for nutrition education and visit to school garden	Knowledge Institute	5 August 2014 In-person interview
58. Café de Ceuvel (Local Food Café)	Discussion with local food/ organic café entrepreneurs, in particular support from local authority to support local food entrepreneurs	Private Sector	5 August 2014 In-person informal discussion
59. MeatTheMushroom (Food Innovator)	Discussion with local food entrepreneur on local authority support for local food entrepreneurs in Amsterdam	Private Sector	5 August 2014 In-person informal discussion
60. Amsterdam Spatial Planning Office	Discussion with city planner on land use planning (re: Amsterdam's periphery) and link between food policy and climate policy	Local Authority	5 August 2014 In-person interview
61. Farming the City (Local Food NGO)	Discussion on The Amsterdam Food Vision to support local food initiatives	Civil Society	5 August 2014 In-person interview
62. University of Amsterdam, researcher on local food policy/ urban agriculture	Discussion on urban agriculture advances over last 10 years in Amsterdam	Knowledge Institute	5 August 2014 In-person interview
63. Damn Food Waste Campaign representative (Local Food NGO)	Discussion on food waste reduction strategies and support from local authority, re: local food strategy	Civil Society	6 August 2014 In-person interview
64. Wageningen University, food waste researcher	Discussion on food waste problem and (lack of) policy support	Knowledge Institute	12 August 2014 In-person interview

65.	Urban Agricultural Project Initiator	Discussion with project coordinator and initiator: *WeteringGroen* Garden	Civil Society	19 September 2014 In-person interview
66.	Amsterdam Spatial Planning Office	Discussion on Amsterdam's Food Vision with project coordinator	Local Authority	20 November 2014 In-person interview
67.	Amsterdam Spatial Planning Office	Discussion on Amsterdam's history of food strategy over last 10 years	Local Authority	2 December 2014 In-person interview conducted by MSc student

82 Former MSc student Renske den Exter performed interviews 8-31 to assist in the PhD project's initial data-gathering phase. Each interview lasted one hour and was conducted by telephone (over the course of November 2011) with the person in charge of climate policy, discussing aspects of mitigation and adaptation strategy development and implementation. These interviews were carried out specifically for the review study (Chapter 2). However some of their findings were later used for the Amsterdam and Rotterdam case studies (Chapters 4 and 5). MSc students under my supervision (Maarten Akkerman and Christiaan Stolk) also conducted interviews 32, 33 and 67, as their master thesis topics aligned with my PhD research and thus we worked closely together.

83 Ongoing discussions with Cityplot persisted (2012- 2014) from working on several urban agricultural projects together as part of participant observation strategy.

84 Ongoing and informal topic discussions (2012- 2014) persisted, as the PhD candidate continued to volunteer with this garden for several growing seasons.

Annex 3: Events Attended

Date and Place	Conference/ Event	Organised By
11-12 August 2008 Mombasa, Kenya	Closing Meeting of Local Agenda 21/ Sustainable Cities Programme Africa and Strategy Meeting on African Cities and Climate Change	UN-Habitat (Attended while interning at UN-Habitat)
3- 6 November 2008 Nanjing, China	World Urban Forum 4	UN-Habitat (Attended while interning at UN-Habitat)
23- 24 June 2009 Malmö, Sweden	Eurocities Environment Forum	Eurocities and the City of Malmö (Attended while working for City of Malmö)
25- 28 November 2009 Stockholm, Sweden	Eurocities General Assembly (Theme: Urban challenges, sustainable solutions)	Eurocities and the City of Stockholm (Attended while working for City of Malmö)
7- 18 December 2009 Copenhagen, Denmark	UN Climate Change Conference, COP15	UNFCCC (Attended while working for City of Malmö)
25 April- 20 May 2010 Shanghai, China	Shanghai World Expo, Urban Best Practice Area	China World Expo (Attended while working for City of Malmö)
29 September- 1 October 2010 Rotterdam, Netherlands	Deltas in Times of Climate Change	Climate changes Spatial Planning Research Programme, Knowledge for Climate Research Programme, The City of Rotterdam, C40
4-9 October 2010 Brussels, Belgium	European Week of Cities and Regions (or Open Days)	EU Committee of the Regions
21- 22 October 2010 Stockholm, Sweden	European Green Capital Conference	The City of Stockholm the EC's European Green Capital Initiative
6 October 2011 Den Bosch, Netherlands	Urban governance in climate change adaptation	European Network of Environmental Professionals
14-15 June 2012 Delft, Netherlands	Water and the City Conference	Technical University Delft
26 November- 8 December 2012 Doha, Qatar	UN Climate Change Conference, COP18	UNFCCC
10 April 2013 Amsterdam, Netherlands	FARMING THE CITY: Food as a tool for today's urbanisation	Cities: The Magazine Pakhuis de Zwijger

23- 25 April 2013 Bali, Indonesia	Seventh Regional Environmentally Sustainable Transport Forum, and Global Consultation on Sustainable Transport in the Post-2015 Development Agenda	UN Centre for Regional Development, Environment Unit
31 May - 02 June 2013 Bonn, Germany	4th Global Forum on Urban Resilience and Adaptation	ICLEI
1 June 2013 Bonn, Germany	Resilient Urban Food Systems Forum	ICLEI
11-13 June 2013 Copenhagen, Denmark	Nordic Environmental Social Sciences Conference	University of Copenhagen
7-9 October 2013 Geneva, Switzerland	74th Session of the Committee on Housing and Land Management and its Ministerial Meeting	UNECE
11-22 November 2013 Warsaw, Poland	UN Climate Change Conference, COP19	UNFCCC
12 February 2014 Zaanstad, Netherlands	E-Harbours Conference (on electricity and smart grids in European harbor cities)	EU Interreg IVB North Sea Programme and City of Zaanstad, City of Malmö, City of Amsterdam
5-11 April 2014 Medellín, Colombia	World Urban Forum 7	UN-Habitat

Summary

Cities are growing at unprecedented rates, home to over half of global population for the first time in history. While there are economic, environmental and other benefits to urban living, there are also consequences, among which cities' major contribution to climate change. Cities release greenhouse gas (GHG) emissions, including from energy consumption in buildings and infrastructure, transportation and industrial processes. Cities are also vulnerable to climate change, including exacerbated urban heat island (UHI) effect and flooding of non-porous surfaces during storm surges. Equally, cities are acting on climate change, adopting strategies to mitigate their GHG emissions, while preparing to adapt to a changing climate.

Within this field of urban climate governance this dissertation examines the role of local authorities, and their interactions with stakeholders, to govern climate change mitigation and adaptation in cities. To do so, it develops a conceptual framework based on the governing capacities that local authorities employ, the governing modes they apply to address climate change, and how local authorities influence and are influenced by vertical and horizontal actors within a multilevel governance system. The main research question this study seeks to address is: *How do forerunning local authorities govern climate change in a city, and how can their effects be improved?* This research question is broken into three sub-research questions:

- How do forerunning local authorities draw upon capacities, and which governing capacities do they apply, to address climate change in a city?
- What governing modes do forerunning local authorities apply to address climate change?
- How can best practices in urban climate change governance be further improved within a particular city and diffused to other cities?

These research questions are addressed by conducting a review study of urban climate governance in Dutch local authorities, followed by three case studies in cities deemed forerunners in urban climate governance. The three case study cities are: Malmö, Sweden and Amsterdam and Rotterdam, the Netherlands. Each case study examines how local authorities interact with a specific stakeholder group to govern climate mitigation and adaptation related to a specific sector: city planning, energy in the build environment, urban agriculture and food.

Methodologically, this dissertation employs a case study research design, using semi-structured interviews, participant observation, and document analysis as its primary data collection methods. A specific question or hypothesis guides each study, including

their respective methodology, data collection and analysis. This dissertation has six chapters: an introduction, four empirical studies and a conclusion.

Chapter 2 conducts an overview of mitigation and adaptation strategies in the 25 largest local authorities in the Netherlands. Specifically it analyses the level of anchoring of climate strategies within policy, in local authorities' organisations and in their practical implementation. It also incorporates a multilevel governance lens to inspect the roles of national and European governing authorities and horizontal networks. This review assisted in the selection of two Dutch forerunners cities, used as case studies in chapters 4 and 5. The analysis reveals several trends: the decentralisation of climate strategies across municipal organisations; the externalisation of climate policies to non-municipal organisations; and the regionalisation of climate strategies, wherein local authorities collaborate with neighbouring municipalities. The Chapter concludes that in the absence of national support, local authorities partner with other stakeholders. Still, full anchoring of their climate strategies remains challenging without sufficient support from national/EU authorities, especially in smaller (less forerunning) local authorities.

Chapter 3 investigates the inner functioning of a local authority organisation, focussing on city planning for climate governance in Malmö, Sweden. Specifically, it examines the role of learning and experimentation to address complex problems, such as climate change. The analysis reveals the importance of deliberate and structured methods to facilitate dialogue and collaboration, both across the departmental silos of a local authority, as well as with citizens and stakeholders, for the design and delivery of integrated climate strategies. In Malmö, this includes connecting climate strategies to the city's long-term vision and city planning to become a sustainable city. The Chapter concludes that by emphasising dialogue and collaboration, and by encouraging flexible methods to address complex problems, learning can become institutionalised, which in turn supports adaptive approaches to address climate change.

Chapter 4 examines the interactions between a local authority with stakeholders in the build environment – such as architects, knowledge institutes, housing corporations and energy corporations – in the design of a new strategy to close resource-waste cycles. The study uses an urban symbiosis lens to analyse the Rotterdam Energy Approach and Planning (REAP). REAP combines urban planning and energy planning to capture waste energy sources, returning them for use in the city's energy grid. The study reveals the dominance of institutional actors in large-scale and technical climate strategies, while civil society engagement is largely absent. Secondly, private sector participation (e.g. energy companies, housing corporations) is limited in REAP's design phase, with only a limited number of local authority experts

and representatives of knowledge institutes initially included. The Chapter concludes that earlier engagement of private sector stakeholders – those later tasked with project execution – already in the design phase is crucial for increasing their ownership and consequent successful project implementation.

Chapter 5 explores the interactions between local authorities and civil society to address climate change. Specifically, it studies Amsterdam's food strategy and urban agricultural initiatives in relation to urban climate governance. While not often linked to local climate policy, urban agriculture has benefits for mitigation (e.g. local food reduces transport emissions) and adaptation (e.g. through preservation of green space). The case study examines how to combine top-down local authority support and bottom-up civil society engagement to integrate urban food strategies and urban agriculture to support climate strategies. The study reveals that while civil society engagement is imperative to address climate change, fragmentation might occur in the absence of central coordination, stagnating implementation of citizen-supported climate strategies. In conclusion the chapter suggests that a more explicit link between urban agriculture/ food strategies and climate strategies, as well as better coordination of civil society-local authority interactions, are vital to address climate change.

Chapter 6 reflects on the dissertation's research questions and draws general conclusions vis-à-vis the governing capacities and governing modes local authorities utilise to facilitate urban climate governance. To engage climate strategies within forerunning cities, the case studies demonstrate a combination of central coordination and decentralised implementation – albeit to varying degrees of success in the different cases. They make use of structured dialogues to engage city departments and key stakeholders, and they allocate different resources to design and deliver climate strategies – the latter being imperative in a time of reduced financial and legal support from national authorities for urban climate governance by cities. In the face of uncertainty, both in terms of the complexity of climate change and the reduction of support, local authorities are moving increasingly towards the governing mode that is called 'governing by enabling'. Increasingly, local authorities are creating partnerships with different stakeholders to develop, implement, diffuse and improve their climate strategies. The contribution of this study to the urban climate governance literature lies in a better understanding of how local authorities in forerunning cities govern climate change. Their governing capacities and modes do engage strongly with different stakeholders, although in distinct ways in different cities and for different urban sectors.

Chinese Summary | 摘要

城市正以前所未有的速度发展， 历史上第一次超过世界一半以上的人口生活在城市。城市不但给城市生活带来经济、环境和其它效益的同时，也对气候变化产生了重大影响。城市排放温室气体，包括建筑和基础设施、运输和工业过程中的能源消耗。城市也容易受到气候变化的影响，包括加剧的热岛效应和非多孔表面在风暴潮中的问题。同时城市也在积极采取各种策略来减缓他们的温室气体排放，积极应对气候变化。

在城市气候治理领域，本论文研究在城市减缓和适应气候变化的治理过程中，地方政府的角色以及他们与其他利益相关者的相互作用。为实现该研究目标，本论文提出一个基于地方政府治理能力的理论框架，治理模式是如何被使用来解决气候变化问题，以及地方政府是如何在多级治理系统中，影响和被纵向和横向的其它参与者影响。该研究主要的研究问题是：领先的地方政府是如何在城市中治理气候变化，以及如何进一步改善他们的绩效？本文的研究问题被分解为三个子研究问题：

- ❖ 领先的地方政府是如何获取治理能力，以及他们如何运用治理能力解决城市中的气候变化问题？
- ❖ 领先的地方政府使用什么治理模式来应对气候变化？
- ❖ 如何进一步改善城市气候变化治理中的最佳方法，在特定的城市内应用以及推广到其他城市？

解决这些研究问题首先通过对荷兰当地政府城市气候治理的回顾分析，接着是三个领先城市气候治理的案例研究。这三个案例研究包括瑞典的马尔默、荷兰的阿姆斯特丹和鹿特丹。每个案例研究探讨地方政府如何与特定的利益相关群体在特定领域的气候减缓和适应治理中相互作用，这些特定领域包括城市规划，建筑环境中的能源，城市农业和食品。

研究方法上，本论文采用案例研究，包括半结构式访谈，参与观察，文档分析作为主要的数据收集方法。由一个特定的问题或假设指导每项子研究，包括它们各自的研究方法，数据收集和分析。本论文共分为六章：绪论，四个实证研究以及结论。

第二章对荷兰二十五个地方政府减缓和适应策略进行概述。具体分析了在当地政府组织的政策及其实际执行过程中，气候策略的稳定水平。它还采用了多层级治理视角去考察国家和欧盟政府及其横向层级组织的角色。该回顾以支持第四章和第五章案例研究两个荷兰领先城市的选择。该分析揭示了几个趋势：气候策略在市级组织的权力下放；气候政策对非市政机构的外部化；气候策略的区域化，以及其中地方政府与周边城市合作。本章的结论是，在缺乏国家的支持下，地方政府与其他利益相关者合作。然而，由于缺乏国家和欧盟政府足够的支持，他们气候策略的完全稳定性仍然充满挑战，特别是在较小的（次领先）地方政府。

第三章研究了地方政府组织的内部运转，重点关注瑞典马尔默城市针对气候治理的城市规划。具体而言，本文研究学习和试验在解决复杂的问题中的角色，比如气候变化。通过分析发现，在地方政府各个部门以及公民和利益相关者之间，为综合气候策略的设计和传递，权衡和结构化方法对促进对话和合作的重要性。在马尔默，这包括将气候策略连接到城市的长期远景和成为可持续发展的城市规划。本章的结论是，通过加强对话和合作，并鼓励灵活的方法来解决复杂的问题，学习可以成为制度化，反过来又成为支持应对气候变化的适应性机制。

第四章探讨了地方政府与利益相关者比如建筑师，知识机构，房屋设计公司和能源公司在建筑环境中的相互作用，设计一种新策略以杜绝资源浪费的循环。本研究采用一个城市共生视角来分析鹿特丹能源方法和计划（REAP）。REAP通过结合城市规划和能源规划来收集能源资源废物，将它们用于城市电网。本研究显示公共机构在大规模技术气候策略中的支配地位，而公民社会的参与却大量缺失。其次，私人部门的参与（例如能源企业，房地产企业）在REAP的设计阶段十分有限，只有有限数量的地方政府的专家和知识机构的代表在最初加入。本章的结论是，这些后来负责项目执行的私人部门利益相关者在设计阶段的早期参与,对增加其所有权和后续项目的成功实施至关重要。

第五章探讨了地方政府和公民社会之间在应对气候变化中的相互作用。具体而言，本章研究与阿姆斯特丹与城市气候治理相关的粮食战略和城市农业举措。虽然不是经常与地方气候政策关联，都市农业具有缓解的效益（如当地食品减少了运输的排放）和适应的效益（如通过绿地的保护）。案例研究分析如何结合自上而下的地方政府支持和自下而上的公民社会参与，以整合城市食品策略和城市农业支持气候策略。研究表明，公民社会参与应对气候变化刻不容缓，分裂可能发生在没有中央协调的情况下，从而使得公民支持的气候策略实施的停滞。总之，本章建议，都市农业/食品战略和气候策略之间更明确的关联，以及更好地协调公民社会与当地政府互动关系，对于应对气候变化的至关重要。

第六章回应本文的研究问题并得出一般性结论，地方政府利用治理能力和治理方式促进城市气候治理。案例研究发现了为了在领先城市紧密结合气候策略,中央协调和分散实施的结合－尽管不同案例中成功的程度不一样。利用结构化的对话将城市各部门和关键利益相关者结合，分配不同的资源支持制定和推广气候策略－当国家政府为城市气候治理的财政和法律支持减少的情况下,后者势在必行。面对由于气候变化的复杂和支持减少的不确定性，地方政府正在日益走向被称为“授权治理’的治理模式。地方当局越来越多地与不同利益相关者的建立合作以发展、实施、推广和改善他们的气候策略。本论文对城市气候治理研究的学术贡献在于通过更好理解地方政府如何在领先城市治理气候变化。尽管在不同的城市、不同的城市部门以不同的方式，地方政府的执政能力和模式与不同的利益相关者紧密联系，

Dutch summary | Samenvatting

Steden groeien als nooit tevoren en zijn op dit moment, voor het eerst in de geschiedenis, de thuisbasis voor een meerderheid van de wereldbevolking. Naast de voordelen hiervan op het gebied van onder andere economie en milieu, zijn er ook nadelen, zoals de bijdrage van steden aan klimaatverandering. Steden stoten broeikasgassen uit, onder andere door energieconsumptie van gebouwen en infrastructuur, transport en industriële processen. Steden zijn ook kwetsbaar voor klimaatverandering, door onder meer het urbane hitte eiland (SHE) effect en het overstromen van verharde oppervlaktes tijdens stormen. Steden nemen actie rondom klimaatsverandering, door mitigatie van broeikasgassen enerzijds en door adaptatie op een veranderend klimaat anderzijds.

Dit proefschrift onderzoekt de rol van lokale autoriteiten, en hun interacties met belanghebbenden, om klimaatmitigatie en -adaptatie in steden te besturen. Hiervoor is in dit proefschrift een conceptueel kader ontwikkeld dat gebaseerd is op de governance capaciteiten die lokale overheden bezitten; de wijze van sturing die zij inzetten om klimaatverandering bespreekbaar te maken en de invloed van lokale autoriteiten op verticale en horizontale actoren in een multi-level governance systeem. De belangrijkste onderzoeksvraag van deze studie is: Hoe besturen vooroplopende stedelijke autoriteiten klimaatsverandering, en hoe kunnen de effecten daarvan worden verbeterd? Deze onderzoeksvraag is onderverdeeld in drie sub-vragen:

- Hoe gebruiken vooroplopende lokale autoriteiten hun capaciteiten en welke governance capaciteiten zetten ze in om klimaatsverandering aan te pakken in een stad?
- Welke wijzen van besturen zetten vooroplopende lokale autoriteiten in om klimaatsverandering aan te pakken?
- Hoe kunnen 'best practices' in stedelijke klimaatsverandering governance verder verbeterd worden in een specifieke stad en hoe kunnen deze naar andere steden verspreid worden?

Deze onderzoeksvragen worden beantwoord door een onderzoek naar klimaat governance bij Nederlandse lokale autoriteiten, gevolgd door drie case-studies in steden die gezien worden als voorlopers op het gebied van klimaat governance. Deze drie case-studies omvatten Malmö, Zweden en Amsterdam en Rotterdam in Nederland. Elke case-study onderzoekt hoe lokale autoriteiten interacties aangaan met specifieke belangengroepen ten behoeve van klimaat mitigatie en adaptatie in een specifieke sector: stadsplanning, energie in de gebouwde omgeving, stedelijke landbouw en voedsel.

Methodologisch volgt deze thesis een case-study onderzoeksontwerp, waarbij gebruik gemaakt is van semi-gestructureerde interviews, participatieve observatie, en document analyse als de primaire dataverzamelingsmethoden. Een specifieke vraag of hypothese structureert elke studie, waaruit ook de methodologie, data verzameling en -analyse voortkomt. Deze dissertatie heeft zes hoofdstukken: een introductie, vier empirische studies en een conclusie.

Hoofdstuk 2 geeft een overzicht van mitigatie en adaptatie strategieën in de 25 grootste gemeentes in Nederland. De analyse richt zich specifiek op drie elementen; het niveau van de verankering van klimaatstrategieën in beleid, de organisatie van lokale autoriteiten en de praktische implementatie. De analyse omvat ook een multi-level governance analyse om de rollen van nationale en Europese overheids-instellingen en horizontale netwerken mee te nemen. Dit overzicht heeft bijdragen aan de selectie van twee Nederlandse steden, die zijn gebruikt als cases in hoofdstukken 4 en 5. De analyse laat verschillende trends zien: de decentralisatie van klimaatstrategieën dwars door gemeentelijke organisaties; de internalisering van klimaatbeleid naar niet-gemeentelijke organisaties; en de regionalisering van de klimaatstrategie, waarbij lokale autoriteiten samenwerken met naburige gemeentes. Het hoofdstuk concludeert dat in de afwezigheid van nationale overheidssteun, lokale autoriteiten gaan samenwerken met andere belanghebbenden. Echter, een sterke verankering van hun klimaatstrategie blijft een uitdaging zonder voldoende support van nationale en EU autoriteiten, met name in kleine (minder vooroplopende) gemeentes.

Hoofdstuk 3 onderzoekt het functioneren van een lokale autoriteit, waarbij de nadruk ligt op stadsplanning voor klimaat governance in Malmö, Zweden. Specifiek onderzoekt het de rol van leren en experimenteren in het aanpakken van complexe problemen, zoals klimaatverandering. De analyse laat het belang zien van intentionele en gestructureerde methoden om dialoog en samenwerking te faciliteren, zowel tussen de verschillende afdelingen van de gemeente, als ook met burgers en belanghebbenden, in het ontwerp van een integrale klimaatstrategie. In Malmö valt hieronder het samenbrengen van klimaatstrategie met de stedelijke lange-termijn visie en stadsplanning gericht op een duurzame stad. Het hoofdstuk concludeert dat leren geïnstitutionaliseerd wordt door de nadruk te leggen op dialoog en samenwerking, en door flexibele methoden toe te passen om complexe problemen aan te pakken. Dit ondersteunt adaptieve benaderingen om klimaatverandering aan te pakken.

Hoofdstuk 4 onderzoekt de interacties tussen een lokale autoriteit en belanghebbenden in de gebouwde omgeving – zoals architecten, kennisinstituten, woningcorporaties en energiebedrijven – in het ontwerp van een nieuwe strategie om de hulpbronnen-

afval cyclus te sluiten. Deze studie gebruikt een 'urban symbiosis' lens om het 'Rotterdam Energy Approach and Planning' (REAP) te analyseren. REAP combineert stedelijke planning en energie planning om rest-energie op te vangen en deze te hergebruiken in het energienetwerk van de stad. De studie laat de dominantie zien van institutionele actoren in een grootschalige en technische klimaatstrategie, terwijl de maatschappelijke organisaties grotendeels afwezig zijn. Daarnaast is de participatie van private partijen (bv. energiebedrijven, woningcorporaties) beperkt in de ontwerpfase van REAP. Slechts een klein aantal gemeentelijke afdelingen en representanten van kennisinstituten waren betrokken. Het hoofdstuk concludeert dat een vroege betrokkenheid van de private sector – degenen die later verantwoordelijk zijn voor de project uitvoering –in de ontwerpfase cruciaal is voor een succesvolle project implementatie.

Hoofdstuk 5 verkent de interacties tussen lokale autoriteiten en maatschappelijke organisaties in het bespreekbaar maken van klimaatsverandering. Dit hoofdstuk kijkt specifiek naar de voedselstrategie en stedelijke landbouwinitiatieven van Amsterdam. Stadslandbouw wordt niet vaak gekoppeld aan lokaal klimaatbeleid, terwijl het veel voordelen biedt voor mitigatie (zoals het reduceren van transport emissies) en adaptatie (door bijvoorbeeld het behoud van groene ruimte). De casus onderzoekt hoe een combinatie gemaakt kan worden tussen top-down ondersteuning door lokale autoriteiten en bottom-up maatschappelijke betrokkenheid, om een integratie te maken tussen stedelijke voedsel strategieën en stadslandbouw ter ondersteuning van klimaatbeleid. De studie laat zien dat maatschappelijke betrokkenheid weliswaar noodzakelijk is om klimaatverandering aan te pakken maar dat dit gefragmenteerd wordt als centrale coördinatie van maatschappelijk gesteunde klimaatstrategieën ontbreekt. Als conclusie suggereert dit hoofdstuk dat een duidelijker link tussen stadslandbouw / voedselstrategie en klimaatstrategie en een betere coördinatie van de interacties tussen maatschappelijke organisaties en lokale autoriteiten van belang is bij de aanpak van klimaatverandering.

Hoofdstuk 6 reflecteert op de onderzoeksvragen en trekt algemene conclusies over de governing capaciteiten en governing modes die lokale autoriteiten gebruiken om stedelijk klimaatbeleid te faciliteren. Wat betreft de klimaatstrategieën van voor-oplopende steden laten de de case studies een combinatie zien van centrale coördinatie en decentrale implementatie – overigens met wisselend succes tussen de verschillende casussen. Ze maken gebruik van gestructureerde dialogen om gemeentelijke diensten en belangrijke private partners te betrekken, en wijzen verschillende hulpbronnen toe aan het ontwerpen en uitvoeren van klimaatstrategieën – waarbij dat laatste imperatief is in een tijd van verminderende financiële en wettelijke ondersteuning vanuit nationale overheden voor het stedelijk klimaatbeleid.

Door onzekerheid, zowel in termen van de complexiteit van klimaatverandering als in de verminderde ondersteuning, verschuiven lokale autoriteiten naar een governing mode die zich richt op 'governing door facilitering. In toenemende mate creëren lokale overheden samenwerkingsverbanden met verschillende belanghebbenden voor het ontwikkelen, verspreiden, uitvoeren en verbeteren van hun klimaatstrategieën. De bijdrage van deze studie aan de literatuur over stedelijke klimaat governance ligt in een beter begrip over het functioneren van lokale autoriteiten van vooroplopende steden rondom het klimaatvraagstuk. Hun governance aanpak richt zich sterk op het betrekken van verschillende belanghebbenden, al zijn er verschillen tussen de verschillende steden en tussen stedelijke sectoren.

Spanish Summary | Resumen

Las ciudades están creciendo en cifras jamás antes vistas, y por primera vez en la historia son el hogar de más de la mitad de la población global. Pese a que la vida urbana trae consigo beneficios económicos, ambientales y otros beneficios, existen también consecuencias, siendo una de ellas que las ciudades son las mayores contribuyentes del cambio climático. Las ciudades liberan emisiones de gases efecto invernadero (GEI), esas emisiones van desde el consumo de energía utilizada en construcción e infraestructura, transporte y procesos industriales. Las ciudades son también vulnerables al cambio climático, incluyendo el exacerbado efecto de la isla de calor (EIC) y la inundación de superficies no porosas durante el surgimiento de tormentas. Igualmente, las ciudades están también actuando, adaptando estrategias para mitigar las emisiones de GEI y preparándose para adaptarse a un clima cambiante.

Dentro del campo de la gobernanza del clima urbano, esta disertación examina el rol de las autoridades locales, y su interacción con actores o grupos de interesados, para gobernar la mitigación del cambio climático y su adaptación en las ciudades. Para lograr esto, se ha desarrollado un marco conceptual basado en las capacidades de gobernanza que las autoridades locales emplean, su formas de aplicarlas y hacer frente al cambio climático, y cómo autoridades locales influencian y son influenciadas por actores verticales y horizontales dentro de un sistema de gobernanza multinivel. La pregunta de investigación principal de este estudio busca dirigir es la siguiente: ¿Cómo autoridades locales *precursoras gobiernan el cambio climático en una ciudad, y cómo sus efectos pueden ser mejorados?* Esta pregunta de investigación ha sido dividida en tres sub-preguntas de investigación:

- ¿Cómo autoridades locales precursoras aprovechan capacidades, y cuáles capacidades de gobernanza ellos aplican, para hacer frente al cambio climático?
- ¿Qué formas de gobierno las autoridades locales precursoras aplican para hacer frente al cambio climático?
- ¿Cómo las mejores prácticas de gobernanza en el cambio climático urbano puede ser mejorado en una ciudad en particular y difundido a otras ciudades?

Estas preguntas de investigación son abarcadas a través de la conducción de un estudio de revisión de la gobernanza de las autoridades locales holandesas sobre el clima urbano, seguido por tres estudios de caso en ciudades consideradas precursoras en la gobernanza del clima urbano. Las tres ciudades donde se condujo estudios de caso son: Malmö, Suecia y Ámsterdam y Rotterdam, los Países Bajos. Cada estudio de caso examina cómo las autoridades locales interactúan con

específicos grupos de actores o grupos interesados para gobernar la mitigación y adaptación del clima en relación a sectores específicos: planificación de la ciudad, energía en el entorno construido, agricultura urbana y alimentación.

Metodológicamente, esta disertación emplea un diseño de investigación de estudio de caso, usando entrevistas semi-estructuradas, observación participante, y análisis de documentos como fuente primaria de métodos de recolección de datos. Una pregunta específica o hipótesis guía cada estudio, incluyendo su metodología respectiva, recolección de datos y análisis. Esta disertación está compuesta de seis capítulos: una introducción, cuatro estudios empíricos y una conclusión.

Capítulo 2 conduce una visión general sobre las estrategias de adaptación y mitigación en las 25 más largas autoridades locales en los Países Bajos. Específicamente, analiza el nivel de anclaje de estrategias climáticas dentro de políticas, en la organización de autoridades locales y su implementación práctica. Este capítulo también incorpora una visión de gobernanza multinivel para inspecciona los roles de autoridades gobernantes nacionales y Europeas y sus redes horizontales. Esta revisión acompaño en la selección de dos ciudades precursores, usadas en estudios de caso en los capítulos 4 y 5. El análisis revela algunas tendencias: la descentralización las estrategias climáticas que atraviesan organizaciones municipales, la externalización de políticas climáticas hacia organizaciones no municipales; y la regionalización de estrategias climáticas, en donde las autoridades locales colaboran con las municipalidades vecinas. El Capítulo concluye que en la ausencia de apoyo nacional, las autoridades locales se asocian con otros grupos de interés. Aun así, el anclaje completo de sus estrategias climáticas continúan siendo un reto sin suficiente apoyo de las autoridades nacionales/UE, sobre todo en (menos precursoras) autoridades locales.

Capítulo 3 investiga el funcionamiento interno de la organización de una autoridad local, enfocándose en la planificación de la gobernanza climática en Malmö, Suecia. Específicamente, examina el rol del aprendizaje y la experimentación para hacer frente a problemas complejos, tal y como lo es el cambio climático. El análisis revela la importancia de métodos estructurados y deliberados para facilitar el dialogo y la colaboración, ambos dentro de los silos departamentales de una autoridad local, así como también con los ciudadanos y grupos de interés, para diseñar y entregar estrategias climáticas integradas. En Malmö, esto incluye conectar estrategias climáticas a la visión a futuro de la ciudad y su planificación para convertirse en una ciudad sostenible. El capítulo concluye que para enfatizar el dialogo y la colaboración, y para promover métodos flexibles y hacer frente a problemas complejos, el aprendizaje puede institucionalizarse, lo que a su vez apoyaría a enfoques de adaptación para hacer frente al cambio climático.

Capítulo 4 examina las interacciones entre autoridades locales y grupos de interés en el entorno construido – tal y como arquitectos, institutos de conocimiento, corporaciones de vivienda y energía – en el diseño de una nueva estrategia para cerrar los ciclos de recursos-residuos. El estudio usa un lente de simbiosis urbana para analizar el Enfoque de Energía y Planificación de Rotterdam (REAP, por sus siglas en Inglés). REAP combina planificación urbana y planificación energética para capturar fuentes de energía desperdiciada, regresándola para ser usada en la red energética de la ciudad. El estudio revela el dominio de actores institucionales en escalas grandes y estrategias climáticas técnicas, mientras que la participación de la ciudadanía es ausente. En segundo lugar, la participación del sector privado (ej. compañías energéticas, corporaciones de vivienda) es limitada en la fase de diseño de REAP, con solamente un número limitado autoridades locales expertas y representantes de institutos de conocimiento inicialmente incluidos. El capítulo concluye que compromisos tempranos con grupos de interés del sector privado – los cuales son asignados con la ejecución de proyectos – desde la fase de diseño es crucial para aumentar la apropiación y éxito consecuente en la implementación del proyecto.

Capítulo 5 explora las interacciones entre autoridades locales y la sociedad civil para hacer frente al cambio climático. Específicamente, estudia la estrategia de alimentación de Ámsterdam e iniciativas de agricultura urbana en relación a la gobernanza del clima urbano. Si bien no es vinculada a la política del clima local, la agricultura urbana tiene beneficios para la mitigación (por ejemplo, la producción de comida local reduce las emisiones del transporte) y la adaptación (por ejemplo, a través de la preservación de espacios verdes). El estudio de caso examina cómo combinar apoyo de -arriba hacia abajo- de parte de las autoridades locales y de -abajo hacia arriba- las acciones de la sociedad civil para integrar estrategias de alimentación urbana y agricultura urbana para apoyar estrategias climáticas. El estudio revela que mientras las acciones de la sociedad civil son imperativas para hacer frente al cambio climático, puede existir fragmentación de estas acciones debido a la ausencia de una coordinación central, estancando la implementación de estrategias climáticas promovidas por los ciudadanos. En conclusión el capítulo sugiere que para hacer frente al cambio climático es vital una conexión más explícita entre agricultura urbana/estrategias alimentarias y estrategias climáticas, así como también una mayo coordinación de las interacciones de la sociedad civil y las autoridades locales.

Capítulo 6 hace una reflexión sobre las preguntas de investigación para esta disertación y saca conclusiones generales vis a vis a las capacidades de gobernanza y a los modos de gobernar que las autoridades locales utilizan para facilitar una

gobernanza del clima urbano. Para conectar estrategias climáticas con ciudades precursoras, el estudio de caso demuestra una combinación de coordinación central e implementación descentralizada – aunque con variados grados de éxito en los diferentes casos. Ellos hacen uso de diálogos estructurados para conectar los departamentos de la ciudad con grupos o actores claves, y también ubican diferentes recursos para diseñar estrategias climáticas – la última siendo imperativa en tiempo de reducido apoyo legal y financiero de parte de las autoridades nacionales a favor de la gobernanza del clima urbano en las ciudades. En la fase de incertidumbre, ambos en términos de complejidad del cambio climático y la reducción del apoyo, autoridades locales se están moviendo cada vez más hacia el modo de gobierno que se conoce como `gobierno habilitante´. Cada vez más, autoridades locales están creando alianzas con diferentes grupos o actores de interés para desarrollar, implementar, difundir y mejorar sus estrategias climáticas. La contribución de este estudio a la literatura de gobernanza climática recae en el mejor entendimiento de cómo las autoridades locales en ciudades precursoras gobiernan el cambio climático. Sus capacidades de gobernanza y sus modos se combinan fuertemente con diferentes actores o grupos de interés, aunque de maneras distintas en las diferentes ciudades y para diferentes sectores urbanos.

About the Author

Jennifer Lenhart was born in Concord, Massachusetts, USA. She grew up in multiple U.S. cities, often spending summers on Sweden's west coast, but considers Seattle home. In 1999, she moved to Haiti to volunteer with an education project; this influenced her later education and career trajectory. In 2000, she enrolled at the University of Washington, studying international relations and development. While at UW, she studied abroad at Khon Kaen University (Thailand) examining the impacts of development on people, cultures and the environment, and at Uppsala University (Sweden) examining sustainable development. After graduating, she worked for several Seattle-based NGOs on urban sustainability.

In 2005, Jennifer moved to Budapest, enrolling in an *Erasmus Mundus* Master in Environmental Sciences, Policy and Management (MESPOM) delivered by several universities, including Central European University (Hungary) and Lund University (Sweden). Afterwards, she held several positions: serving on the Erasmus Mundus Alumni Board; assisting research at Lund University's International Institute for Industrial Environmental Economics; and interning at Malmö's City Planning Office (Sweden) and at UN-Habitat's Urban Environmental Planning Branch in Nairobi, Kenya. Both internships concentrated on urban sustainability, from a policy and planning perspective. In 2009, she returned to Malmö, to a position at its Environment Department, profiling the city's climate strategies.

In 2010, Jennifer moved to Wageningen (the Netherlands) for a PhD in urban climate governance, focussing on Northern European cities. Her fascination with urban planning and design, in particular how people interact in and with cities, motivated her to start a blog, *the Urban Observer,* which was recognised by the British news media source, *The Guardian*, on their *Guardian Cities* website. Throughout her PhD, she also worked as a freelance writer for the International Institute for Sustainable Development's Earth Negotiations Bulletin, covering multilateral environmental agreements, while providing her research on (urban) climate policy a global perspective. After submitting her dissertation, Jennifer has continued freelancing, while looking for a consultancy or policy position in the same field of urban climate governance. Additionally, she hopes to stay close to academia, notably for teaching and supervising.

List of Publications

Scientific Referred Articles in International Journals

Den Exter, R., **Lenhart**, J., Kern, K. 2014. Governing climate change in Dutch cities: anchoring local climate strategies in organisation, policy and practical implementation. Local Environment doi:10.1080/13549839.2014.892919.

Fitzgerald, J., **Lenhart**, J., 2015. Ecodistricts: Can They accelerate Urban Climate Planning? Environment and Planning C: Government and Policy (Forthcoming).

Laukkonen, J., Kim-Blanco, P., **Lenhart**, J., Keiner, M., Cavric, B., Kinuthia-Njenga, C., 2009. Combining climate change adaptation and mitigation measures at the local level. Habitat International 33(3): 287-292.

Lenhart, J., Bouteligier S., Mol, A.P.J., Kern. K., 2014. Cities as learning organisations in climate policy: the case of Malmö. International Journal of Urban Sustainable Development 6(1): 89-106.

Lenhart, J., Van Vliet, B., Mol, A.P.J., 2015. New roles for local authorities in a time of climate change: the Rotterdam Energy Approach and Planning as a case of urban symbiosis. Journal of Cleaner Production. doi:10.1016/j.jclepro.2015.05.026.

Book Chapters

Lenhart, J., 2013. The Western Harbour in the world. In Persson, B. (Eds) The Western Harbour – experiences and lessons learned. Arkus Research and Development for Architecture and the Built Environment, Malmö. pp. 215- 220.

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SENSE PhD Courses

- Innovation for Sustainability: Bringing Theory into Practice (2010)
- Earth System Governance (2011)
- Environmental Research in Context (2011)
- Social Theory and the Environment: Introduction into Ecological Modernisation Theory (2011)
- Research in Context Activity: Established project blog, entitled "The Urban Observer" on sustainable cities and citizen behaviour (2012-ongoing) and lectured in a Massive Open Online Course (MOOC) at Lund University, entitled "Greening the Economy: Lessons from Scandinavia" describing PhD project's focus on urban climate governance (2014)

Other PhD and Advanced MSc Courses

- From topic to proposal, Wageningen University (2010)
- Project and time management, Wageningen University (2011)
- NORD-STAR Climate Adaptation Policy, University of Iceland (2012)
- Techniques for writing and presenting a scientific paper, Wageningen University (2012)
- NORD-STAR Climate Strategy and Adaptation Economics, University of Iceland (2013)

External training at a foreign research institute

- Guest Researcher, focus on adaptive governance, VU University Amsterdam (2013)

Management and Didactic Skills Training

- Organiser of ENP MSc colloquia and member of the ENP Social Media Team (2010-2014)
- Lecturer in MSc courses 'Academic Consultancy Training (2010), 'Climate Governance'(2012-2013), 'Principles of Environmental Science' (2011- 2013), 'Principles of Urban Environmental Management' (2013), and 'Environmental Policy Analysis & Evaluation (2013-2014)
- Co-organiser of SENSE PhD Meeting on 'Communication of scientific research' (2011)
- Co-supervisor of 5 MSc students (2011-2015)
- Teaching assistant (2011, 2013) and lecturer in MSc course 'Governance for Sustainable Cities' (2011-2015)
- Co-organiser "ENP PhD Trip", visiting academic & policy institutions in Sweden & Denmark (2012)

Selection of Oral Presentations

- *Closed-system cities? Exploring interactions between local authorities and key actors to develop resource-balanced cities: the case of the Rotterdam energy approach to planning*. Nordic Environmental Social Science Conference, 11-13 June 2013, Copenhagen, Denmark

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