Urban climate adaptation as a process of organisational decision making

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Climate; adaptation; cities; process; local government; decision making; governance;

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Abstract

In a world that is increasingly urbanised, cities are recognised as critical sites for tackling problems of climate change, both by reducing greenhouse gas emissions and addressing the impacts of changing climate conditions. Unlike climate change mitigation, adaptation does not have one clear, commonly agreed collective goal. Governing and making decisions on climate adaptation in cities entails contestation over knowledge, values and preferences. Currently, the two dominant conceptualisations of adaptation are as cycles or pathways. Do these models adequately theorise what can be empirically observed in cities as to how climate adaptation is undertaken? Most research on urban climate adaptation emanates from the Global North, where political, scientific, economic and administrative systems are well established and well resourced. There is a dearth of empirical research from cities of the Global South contributing to the development of urban climate adaptation theory. This thesis contributes to addressing this gap in two ways. Firstly, by drawing on both conceptual and methodological resources from the field of organisational studies, notably the streams and rounds models of decision making, organisational ethnography and processual case research. Secondly, by conducting empirical case study research on three processes of city scale climate adaptation in Cape Town, South Africa, a growing city facing many development challenges where the local government began addressing climate adaptation over ten years ago. The three adaptation processes studied are: the preparation and adoption of city-wide sectoral climate adaptation plans; the creation of a City Development Strategy with climate resilience as a core goal; and the inclusion of climate change projections into stormwater masterplans. Data were gathered through interviews, participant observation, focus groups and document review, through embedded research within a formal knowledge co-production partnership between the University of Cape Town and the City of Cape Town government. Processual analysis and applied thematic analysis were used to test models of adaptation and decision making against data from the three case studies. The findings suggest that both the cycles and pathways models of climate adaptation inadequately represent the contested

and contingent nature of decision making that prevail within the governance systems of cities such as Cape Town. Based on ethnographic knowledge of how Cape Town's local government undertakes climate adaptation, it is argued that the rounds model of decision making provides conceptual tools to better understand and represent how the process of climate adaptation in cities is undertaken; tools that can be used to enhance the pathways model. The study concludes that progress in adapting cities to a changing climate is currently constrained by both the problems and potential solutions or interventions being too technical for most politicians to deal with and prioritize and too political for most technical and administrative officials to design and implement. It calls for urban climate adaptation to be understood as distributed across a multitude of actors pursuing concurrent, discontinuous processes, and thereby focus needs to be on fostering collaboration and coordination, rather than fixating on single actors, policies, plans or projects.

Preface

Some of the text included in this thesis, or alternative versions of it, has already been published or is in the process of being published, as outlined below:

- Parts of Chapter 5: South African context for addressing climate change in cities, have been published as a chapter (Taylor et al., 2016) in an edited volume entitled 'Climate Change: Law and Governance in South Africa' (Humby et al., 2016);
- Most of Chapter 6: Cape Town's climate adaptation context, is currently in the process of being published as a book chapter by Taylor and Davies (forthcoming) in an edited volume, produced through the Mistra Urban Futures Knowledge Partnership and being published by University of Cape Town Press, entitled 'Urban Development and Climate Change: Lessons from Cape Town' (Scott et al., forthcoming);
- Parts of Chapter 7: Creating Climate Adaptation Plans of Action, have been published in an earlier version as a report (Taylor et al., 2014) in the Focales Series produced by the Agence Francaise de Developpement (AFD), and in the final version as a journal article (Taylor, 2016) in the International Journal of Climate Change Strategies and Management;
- Some of the material included in Chapter 8: Climate Change in City Development Strategic Planning, has contributed to a report entitled 'Integrating Climate Change into City Development Strategies (CDS): Climate Change and Strategic Planning' (Ruijsink, 2015) produced for UN-Habitat;
- Most of Chapter 9: Climate Adaptation in Stormwater Management, is currently in the process of being published as a book chapter by Taylor (forthcoming) in an edited volume, produced through the Mistra Urban Futures Knowledge Partnership and being published by University of Cape Town Press, entitled 'Urban Development and Climate Change: Lessons from Cape Town' (Scott et al., forthcoming).

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List of acronyms and abbreviations

ACC	African Centre for Cities
BioNet	Biodiversity Network
CAPA	Climate Adaptation Plan of Action
CCT	City of Cape Town
CDP	Clean Development Mechanism
CDS	City Development Strategy
CFO	Chief Financial Officer
CMP	Coastal Management Programme
COGTA	Department of Co-operative Governance and Traditional Affairs
CSAG	Climate Systems Analysis Group
D-MOSS	Durban Metropolitan Open Space System
Danida	Danish Development Agency
DEA	Department of Environmental Affairs
DiMP	Disaster Mitigation Programme
ECAP	Energy and Climate Action Plan
EESPCo	Economic, Environmental and Spatial Planning Committee
EMG	Environmental Monitoring Group
EMT	Executive Management Team
ERC	Energy Research Centre
ERMD	Environmental Resource Management Department
FAC4T	Framework for Adaptation to Climate Change in the City of Cape Town
GCCA	Global Climate Change Alliance
GCM	General Circulation Model
GDP	Gross Domestic Product
GEECC	Green Economy, Energy and Climate Change Working Group
GHG	greenhouse gases
GVA	Gross Value Added
ICLEI	International Council for Local Environmental Initiatives
ICMA	Integrated Coastal Management Act
IDP	Integrated Development Plan
IHS	Institute for Housing and Urban Development Studies
IMEP	Integrated Metropolitan Environmental Policy

IPCC	Intergovernmental Panel on Climate Change
MFMA	Municipal Finance Management Act
MINMEC	Ministers and Members of Executive Councils
MINTECH	Ministerial Technical Advisors
MSF	Multiple Streams Framework
MUF	Mistra Urban Futures
NCA	US National Climate Assessment
NCCRP	National Climate Change Response Policy
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NRC	US National Research Council
NWA	National Water Act
PMS	Performance Management System
RADAR	Research Alliance for Disaster Risk Reduction
RSA	Republic of South Africa
SACN	South African Cities Network
SALGA	South African Local Government Association
SANBI	South African Biodiversity Institute
SDF	Spatial Development Framework
SEA	Sustainable Energy Africa
SEED	Sustainable Energy for Environment and Development
SPLUMA	Spatial Planning and Land Use Management Act
SSN	SouthSouthNorth
TAU	Technical Assistance Unit in National Treasury
UCLG	United Cities and Local Governments
UCT	University of Cape Town
UEM	Urban Environmental Management
UKCIP	UK Climate Impacts Programme
UKZN	University of KwaZulu Natal
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WCG	Western Cape Government

WEF	World Economic Forum
WSA	Water Services Act
WWF	World-Wide Fund for Nature

Chapter 1: Introduction

1.1. Cities and local governments are key to tackling climate change

The concentration of people, economic activities and infrastructure investments makes cities central to addressing climate change, both in terms of reducing emissions of greenhouse gases and managing climate impacts. This is increasingly recognised and emphasised internationally, including in the recently adopted policy frameworks of the 2030 Agenda for Sustainable Development (United Nations (UN), 2015a), the Paris Agreement (UN, 2015b) and the New Urban Agenda (UN, 2016). Local governments play a key role in guiding and coordinating the actions and actors shaping the development trajectories of cities and thereby how cities deal with climate change. Yet there is limited knowledge of how city governments play this role, especially outside of a few well-resourced cities in Europe and North America. The research reported here contributes to addressing this knowledge gap, theoretically and empirically, by building a process-based understanding of how climate adaptation features in the decision making of the city government in Cape Town, South Africa.

Cities are complex and dynamic entities, connected with many other places both rural and urban, and with a range of scales of organising and activity, from the very local to the supra-national. This makes cities particularly interesting and challenging to understand and govern. The number and size of cities continue to grow, especially in so-called developing regions of the world, often referred to as the Global South, including much of Asia, Latin America and Africa. However, research into addressing climate change in cities of the Global South remains scarce when compared with knowledge produced on climate risks, greenhouse gas emissions, adaptation and mitigation options and governance arrangements in cities of the Global North. There is much rhetoric around ideas of 'leapfrogging' to low carbon and climate resilient forms of urban development, knowledge exchange and learning networks. The suggestion is that newer,

less developed and less formalised cities can and should avoid the development trajectories of European and North American cities that have made them heavy emitters of greenhouse gases and highly susceptible to costly damages and losses from climate impacts. Yet little context-sensitive research exists that empirically examines the ways in which these cities currently function in relation to the climate, the ways in which climate change is conceptualised and problematised in these places, and the conditions that enable or inhibit climate mitigation and adaptation from being undertaken.

Research on climate change, including that on cities and climate change specifically, tends to focus either on mitigation or on adaptation, i.e. on the problem of how to slow down, reduce and reverse anthropogenic changes to the global climate system or on the problem of how to deal with the consequences of a changing climate. While these are closely interrelated problems, the nature of the problems, the kinds of solutions or interventions being explored and the actors involved in undertaking the research, taking decisions and implementing options, tend to be quite different (Dovers, 2009). For example, energy, transport and industrial production are central to climate change mitigation, while water, health and disaster management are central to adaptation. There are some key areas of overlap and synergy between climate mitigation and adaptation, many of which are critical to cities, such as spatial planning, built and ecological infrastructure, and food systems. The point of entry for this study is climate adaptation at the city scale, but giving cognisance to potential linkages with climate mitigation at this scale. Beyond the mitigation-adaptation divide, research on cities and climate change adaptation focuses to varying degrees on existing and/or projected climate risks, vulnerabilities, impacts and response measures, and how to organise and govern the development, selection, implementation and evaluation of such innovations and interventions. It is this last aspect that is the particular focus of this study, which aims to make an intellectual contribution at the nexus of adapting to climate change, urbanisation across Africa and processes of decision making at the city scale led by local governments.

1.2. Research questions and approach

To interrogate the core issue of how well placed city governments are to fulfil the role of tackling the global problem of climate change, as is being lobbied within the international policy arena, the primary research question under study is: how does climate adaptation happen at the city scale? In order to address this, three sub-questions are addressed:

1. What evidence is there of climate adaptation happening in a city and how can such evidence be collected and analysed?
2. Who or what is involved in progressing and/or inhibiting climate adaptation from happening at the city scale, and in what way?
3. What is the temporality of climate adaptation occurring at the city scale?

To address these research questions, the study draws together and interrelates conceptual and theoretical insights from research into adaptation governance, adaptive cycles, adaptation pathways and models of decision making to investigate how combining these help to better understand observed processes of urban climate adaptation unfolding in Cape Town, South Africa. Organisational ethnography and processual case research are combined to empirically investigate three instances of climate adaptation evident in Cape Town. Four conceptual models, identified in the literature on climate adaptation and decision making, are applied across the three empirical cases to make sense of the composite urban adaptation process.

1.3. Thesis outline

The thesis is structured and presented as follows. Chapter 2 reviews existing scholarship on climate adaptation as it pertains to cities or urban settlements around the world, identifying key debates

and notable gaps in the literature. Chapter 3 reviews research on public policy decision making. The vast majority of decision-making research does not deal with choices made at the city scale relating to the climate, but it offers an analysis and understanding of public policy decisions that I propose can further and greatly enhance knowledge and implementation of urban climate adaptation. Chapter 4 focuses on methodology of this study, describing and providing a justification for the data collection and analysis methods used in investigating climate adaptation at the city scale from a local government decision-making perspective, and specifically a process-based view of decision making.

Before exploring the details of climate adaptation decision-making processes within Cape Town's local government, Chapters 5 and 6 set the scene. Chapter 5 briefly introduces the state of cities in South Africa and how climate impacts manifest in South Africa's urban contexts. It presents a review of the national legal and policy framework, exploring the mandates given and provisions made for South African city governments to undertake climate adaptation. Then, primarily from a local government practitioner perspective, the chapter suggests nine challenges facing South African city governments that inhibit the planning and implementation of urban climate adaptation despite a conducive legislative and policy framework. Chapter 6 describes the main features of Cape Town's urban development, it's local climate and the ways in which climate and development intersect in Cape Town, as well as the governance arrangements within which the Cape Town city government tackles climate change.

Chapters 7, 8 and 9 present three case studies of climate adaptation as processes of decision-making led by local government, undertaken in Cape Town. Chapter 7 investigates the process by which Climate Adaptation Plans of Action (CAPAs) were developed for particular sectors identified as being at risk from climate impacts. Particular attention is paid to which actors (disaggregating administrative units and political bodies within the local government) were involved in the CAPA process and in what ways;

the sequence of events that gave rise to the plans; and what decisions and actions the plans led to. Work on developing the CAPAs began in 2005/6, which marks the first concerted effort at articulating what climate adaptation might practically entail within the specific context of Cape Town. Chapter 8 examines the process by which a City Development Strategy (CDS) was produced and adopted by Cape Town's city government in consultation with other stakeholders, looking at how climate problems and potential solutions or interventions feature in the strategy. Preparation for creating a Cape Town CDS, which began in 2008, was an attempt at mainstreaming climate adaptation thinking and priorities into a high-level strategic planning framework that integrates different sectors. The third case study, dealt with in chapter 9, then takes a closer look at how the climate adaptation agenda gains traction within a branch of Cape Town's city administration mandated to manage stormwater and flood risk. The chapter presents an analysis of how information about projected future climate conditions has been included in master planning at the catchment scale to make decisions about infrastructure and land management in the light of changing flood risks.

After presenting each of the case studies separately, Chapter 10 provides an analysis across the three case studies by applying the adaptation cycle model, the adaptation pathways model, the streams model of decision making and the rounds model of decision making that were profiled from the literature reviewed in Chapters 2 and 3. The chapter discusses how a conceptual framework that views urban climate adaptation as a process of decision making helps to make sense of the variety of evidence that can be found when studying climate adaptation from inside a city government. This process-based understanding of urban climate adaptation decision making makes more clearly legible the complex, contingent and emergent nature of how cities change and are adapted in relation to experienced and anticipated climate conditions. Finally, Chapter 11 concludes by summarising the key features of the study

and articulating the main methodological, empirical and theoretical contributions that the study makes to the field of urban climate adaptation knowledge and practice.

1.4. Key findings

Based on the empirical findings from examining in depth cases of climate adaptation undertaken by Cape Town's city government, this study suggests that both the cycles and pathways models inadequately conceptualise how processes of urban climate adaptation unfold. It is proposed that urban climate adaptation is not usefully understood as one central decision made by one central actor sequentially undertaking steps in which the problem is clearly defined and a full set of options are rationally assessed, prioritised, implemented and evaluated. Nor is it adequately understood as a proliferating set of pathways, with each pathway made up of a series of decision cycles. Rather, ethnographic and processual evidence from Cape Town shows that, in practice, urban climate adaptation involves a multiplicity of actors making decisions in parallel, although with various interlinkages, that create an emergent policy agenda associated with disparate and intermittent implementation activities. The study concludes that Teisman's (2000) rounds model of decision making, building on Kingdon's (1984) streams model, provides useful conceptual tools for understanding the complexity of urban climate adaptation processes and further developing Wise et al.'s (2014) adaptation pathways model. This conceptual development in the field of climate adaptation theory, based on empirical research from a South African city that supplements the core body of work being undertaken in cities of the Global North, may prove important for implementing the 2030 Agenda for Sustainable Development (UN, 2015a), the Paris Agreement (UN, 2015b) and the New Urban Agenda (UN, 2016). An alternative theorisation of urban climate adaptation may better equip those operating in and supporting cities, including local governments, higher levels of governments, UN agencies and international networks like C40 and United

Cities and Local Governments (UCLG), to effectively negotiate and coordinate roles, responsibilities for and resourcing of actions to address climate risks and vulnerabilities at the city scale.

Chapter 2: Theorising urban climate adaptation

2.1. Introduction: cities and climate adaptation

The intersection between cities and climate change is a relatively new but rapidly expanding field of research (Betsill and Bulkeley, 2007; Hallegatte and Corfee-Morlot, 2010; Romero-Lankao and Dodman, 2011; While and Whitehead, 2013; Knieling and Klindworth, 2016). The focus initially was on greenhouse gas (GHG) emissions from cities and the role cities could, should and are playing in climate change mitigation (Betsill, 2001; Betsill and Bulkeley, 2007; Satterthwaite, 2008; Dodman, 2009; Hoornweg et al., 2011). The spotlight was primarily cast on large cities of the Global North where size, urban form and consumption patterns make for high levels of GHG emissions. However, mirroring an international shift over the last decade (reflected in both the United Nations Framework Convention on Climate Change (UNFCCC) negotiations and the work of the Intergovernmental Panel on Climate Change (IPCC)), attention within the cities and climate change field has increasingly been placed on climate change impacts and adaptation, alongside (and occasionally in relation to) ongoing emissions and mitigation work (Rosenzweig et al., 2010; Otto-Zimmermann, 2011; Bulkeley and Tuts, 2013; Pauleit et al., 2015). The impacts of Hurricane Sandy on New York City in 2012 brought work on building climate resilience[1] to the fore, which has been influential in raising the profile of the urban climate adaptation agenda internationally. This is evidenced by the rise of the C40 network, previously led by Michael Bloomberg during his tenure as Mayor of New York City and currently led by the Mayor of Paris, Anne Hidalgo. Bloomberg, in addition to being President of the C40 Board, has since taken up a new role as the U.N. Secretary-General's Special Envoy

[1] The notion of resilience is increasingly being used in the climate change field as an alternative or complement to the concept of adaptation. Resilience focuses on how systems resist, accommodate and alter in response to a range of changes in their environment, including the climate. In recognition of this growing policy discourse, resilience is referred to on numerous occassions in this dissertation. However, for analytical purposes this study focusses on and contributes to the concept and theory of climate adaptation. See sections 2.2 and 2.7 for definitions of adaptation and resilience respectively as used in this study.

for Cities and Climate Change, a sign of the importance being placed on cities tackling climate change. The importance is further increased by the emphasis placed on addressing climate change through low-carbon and climate resilient urbanisation in the New Urban Agenda, recently adopted at the third UN Conference on Housing and Sustainable Urbanisation (Habitat III) in Quito.

Research on urban climate adaptation can broadly be categorised into four inter-related sub-fields, namely: (1) climate hazards, risks and impacts faced by cities; (2) climate vulnerability and resilience, equity and justice within and between cities (with strong linkages to research on urban poverty and development); (3) planning for and managing climate risks and impacts in cities (notably including spatial planning, infrastructure planning and ecosystem management that accounts for and addresses climate risks); and (4) the governance, institutional arrangements and organisation of urban climate adaptation. Various debates within the urban climate adaptation literature span two or more of these sub-fields. For example, work in sub-field 1 on climate impacts in cities includes quantifying economic costs and losses, which extends to estimating the benefits of investing in adaptation, linking strongly to sub-field 3 on planning and managing urban climate adaptation. Questions about barriers to urban adaptation and mainstreaming climate adaptation into urban development links sub-fields 3 and 4. Research on mal-adaptation draws in aspects of sub-themes 1, 2 and 3. And debates around transformative adaptation deal mainly with the linkage between sub-fields 2 and 4. Work within the domain of climate science and meteorology aimed at supporting decision making in cities, increasingly referred to as 'climate services', connects sub-fields 1 and 3, with notions of knowledge co-exploration and co-production linking also to sub-field 4. Cutting across these four sub-fields in urban climate adaptation research are two primary scales of analysis: (A) the sub-city scale, which is focused on particular spatial areas (e.g. neighbourhoods, wards, districts), social groups, communities, organisations or sectors (e.g. water, transport, health or alike) within a city; and (B) the city-wide scale, which attempts

to deal with the city as a whole, although the boundaries of what constitutes a city are often defined in different ways. An overview of the body of research in published academic literature that deals with these various aspects of urban climate adaptation is provided in table 1 below, listed in chronological order.

Table 1: A typology of urban climate adaptation research

Research foci versus scale of research	A) Sub-city scale (i.e. specific urban sector, locality, social group)	B) City-wide scale
1) Climate hazards, risks and impacts faced by/in cities	Kovats and Akhtar (2008); Romero-Lankao (2010); Ranger et al. (2010); Zimmerman and Faris (2010); Brundrit and Cartwright (2012); Harris et al. (2012)	Lindley et al. (2006); Grunthal et al. (2006); Hallegatte et al. (2007); Hunt and Watkiss (2011); Hallegatte et al. (2011a); Hallegatte et al. (2011b); Walsh et al. (2013); Hallegatte et al. (2013); Revi et al. (2014)
2) Climate vulnerability, equity and justice within and between cities	Douglas et al. (2008); Dodman and Satterthwaite (2008); Wilhelmi and Hayden (2010); Romero-Lankao (2010); Kabisch et al. (2015); Qin et al. (2015); Roy et al. (2016)	Sherbinin et al. (2007); Bicknell et al. (2009); Hardoy and Pandiella (2009); Aylett (2010); O'Brien and Wolf (2010); Romero Lankao and Qin (2011); Bulkeley et al. (2013); Hughes (2013); Kiunsi (2013); Wamsler et al. (2013); Bulkeley et al. (2014); Benzie (2014); Pelling et al. (2014); Carter et al. (2015); Akukwe and Ogbobo (2015); Simon and Leck (2015); Pauleit et al. (2015); Steele et al. (2015); Shi et al. (2016)
3) Planning for and managing climate risks and impacts in cities	Rosenzweig et al. (2007); Gill et al. (2007); Laukkonen et al. (2009); Ziervogel et al. (2010); Otto-Zimmermann (2011); Haque et al. (2012); Roberts et al. (2012); Ranger et al. (2013); Barnett et al. (2014); Lindley (2015); Broto et al. (2015)	Mukheibir and Ziervogel (2007); Lindley et al. (2007); Wilson (2007); Revi (2008); Davoudi et al. (2009); Rosenzweig and Solecki (2010); Kithiia and Dowling (2010); Roberts (2010); Quay (2010); Measham et al. (2011); Solecki et al. (2011); Leichenko (2011); Carmin et al. (2012a&b); Tyler and Moench (2012); da Silva et al. (2012); Cartwright et al. (2013); Roberts and O'Donoghue (2013); Davoudi et al. (2013); Romero-Lankao and Gnatz (2013); Anguelovski et al. (2014); Herslund et al. (2015); Hughes (2015); Solecki et al. (2015); Parnell (2015)
4) Governing, institutionalising and organising urban climate adaptation	Berkhout et al. (2006); Dodman and Satterthwaite (2008); Storbjörk (2010); Berkhout (2012); Archer et al. (2014); Ziervogel et al. (2014a);	Roberts (2008); Winsvold et al. (2009); Fünfgeld (2010); Birkmann et al. (2010); Corfee-Morlot et al. (2010); Aylett (2010); Anguelovski and

	Colenbrander et al. (2015); Sutherland et al. (2015)	Carmin (2011); Leck et al. (2011); Runhaar et al. (2012); Aylett (2013); Bulkeley (2013); McEvoy et al. (2013); Mazmanian et al. (2013); Pasquini et al. (2013); Biesbroek et al. (2013); Whitehead (2013); Uittenbroek et al. (2013); Pelling et al. (2014); Biesbroek et al. (2014b); Uittenbroek et al. (2014); Taylor et al. (2014); Mees et al. (2014); Boyd et al. (2014); Adu-Boateng (2015); Boyd and Juhola (2015); Zaidi and Pelling (2015); Aylett (2015); Ricci et al. (2015); Vedeld et al. (2015); Pasquini et al. (2015); Simon and Leck (2015); Leck and Roberts (2015); Pauleit et al. (2015); Fünfgeld (2015); Moloney and Fünfgeld (2015); Chu et al. (2016); Ziervogel et al. (2016); Huitema et al. (2016); Termeer et al. (2016a); Knieling (2016)

Contained within the body of literature relating to climate adaptation in urban areas, as reflected in table 1, are a number of debates. These debates pertain to questions of:

1. What climate changes have been happening at the city scale, and what changes could be expected (are more or less likely) in the coming decades, that need to be prepared for and adapted to (often framed as an assessment of climate risks)?
2. How are cities as places, populations, economies and complex systems (i.e. ecological, infrastructural, social, cultural, technical, political and economic systems) impacted by various changes in the climate?
3. Who, what and where in a city or between cities is most impacted or are most able to avoid the worst of the impacts (usually framed as either a vulnerability, adaptive capacity or resilience assessment, with varying emphasis placed on social and physical aspects or variables)?
4. What do and will climate impacts in cities cost and to whom does the burden of those costs fall?

5. How is urban climate adaptation conceptualised and framed in different ways (e.g. as reducing vulnerability, managing risk, building resilience, as a series of steps, a cycle or a pathway)?
6. What kinds of adaptations or innovations are being made or are needed in cities to address, reduce and redistribute climate risks, vulnerabilities and impacts?
7. Do these adaptations or innovations constitute a gradual, incremental transition or a radical transformation that breaks from the current status quo?
8. Who stands to benefit and lose from such changes?
9. How is consensus built and/or contestation dealt with regarding the nature, scale and location of adaptations or innovations to invest in, as a basis for policy-making, planning and implementation in cities? Or in other language, how is climate adaptation of cities governed?
10. How can more radical, transformative changes be stimulated and progressed, especially those that shift the balance of power and distribution of resources?
11. What constitutes mal-adaptation and how can it be avoided?

With the primary aim of progressing our understanding of how climate adaptation happens at the city scale, this study focuses on and contributes to debates around questions 5, 6 and 9. In this chapter, attention is therefore placed on reviewing literature that deals with conceptualising the process of climate adaptation and how it is governed, i.e. that listed in cell 4B in table 1 above. As Gillard et al. (2016, p.252) suggest: "*... the way climate and society relations are conceptualised greatly influences the way their co-evolution is interpreted and responded to*". The key themes identified in the climate adaptation literature discussed in the subsequent sections of this chapter are: understanding climate adaptation as a process; the conceptual model of climate adaptation as a cycle of sequential steps; the growing focus on learning and experimentation within the adaptation literature; the conceptual model of climate adaptation as a

set of proliferating pathways; and the application of governance theories to explain and address the challenges of climate adaptation.

2.2. Climate adaptation as a process

What is climate adaptation understood to be? How has it been defined, characterised and theorised, in general and as occurring in cities specifically? Much work on climate adaptation refers to the definition given in the most recent IPCC report. It is interesting to note how this definition has changed through the series of reports. The First Assessment Report of the IPCC (1990, p.54) defines adaptation simply as "*measures to diminish the adverse effects of climate change*". The IPCC's Second Assessment Report (1995, p.28) does not define adaptation but rather provides a definition of 'adaptability' as "*the degree to which adjustments are possible in practices, processes or structures of systems to projected or actual changes of climate. Adaptation can be spontaneous or planned, and can be carried out in response to or in anticipation of changes in conditions*." The Third Assessment Report (IPCC, 2001, p.365) goes on to define adaptation as: "*Adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation*." In the Fourth Assessment Report (IPCC, 2007, p.76) the definition for adaptation is given as: "*Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned. Examples are raising river or coastal dikes, the substitution of more temperature-shock resistant plants for sensitive ones, etc*." And most recently, in the Fifth Assessment Report (IPCC, 2014, p.118) it is defined as:

"*The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects*." It is noted that "*Reflecting progress in science, this glossary entry differs in breadth and focus from the entry used in the Fourth Assessment Report and other IPCC reports*." As indicated in this note, the definitions given in the IPCC reports are themselves a reflection of the established consensus within the body of peer-reviewed, published scientific research available at the time, showing the evolution of scholarship on climate adaptation as a concept and a practice. Over time the breadth and focus of what constitutes climate adaptation has indeed shifted, from measures and adjustments to processes, from separating natural and human systems to seeing them as inter-connected, from distinguishing between spontaneous or planned and anticipatory or reactive adaptation to also distinguishing between private and public forms of adaptation, and finally expanding from a focus only on diminishing adverse effects to also exploiting beneficial opportunities of actual and/or projected changes in climate conditions. Of particular significance to this study is the inclusion in the most recent IPCC definition of the word 'process'. This shifts attention beyond the measures and initiatives themselves to consider the temporality and sequencing of such actions and the conditions that are conducive, or not, to taking such actions. It reflects recent research into how adaptation unfolds or happens, which is where this thesis seeks to make a new contribution.

2.3. Adaptation as a cycle

Drawing heavily on risk management frameworks, much of the adaptation literature conceptualises and represents the process of adaptation as a set of steps or stages, sometimes depicted as a linear sequence but often within a cyclical process of repeatedly iterating through the steps (Willows

et al., 2003; Fussel, 2007; Moser and Ekstrom, 2010; Knieling and Klindworth, 2016). The steps involve some version of problem identification, assessment of climate risks and/or vulnerability, identification of potential adaptation options, evaluation and selection of options, implementation of selected options, monitoring and evaluation of implementation and outcomes, reassessment of the problem and repeating the steps. Some include stakeholder engagement and public participation as a step or an approach to be taken in numerous steps. This conceptualisation of adaptation as a cyclical process of undertaking various steps appears in numerous assessment reports, guidance materials, handbooks and support tools aimed at practitioners. For example, the UNFCCC's guidance for developing a National Adaptation Plan (LDC Expert Group, 2012), the Adaptation Wizard tool developed by the UK Climate Impacts Programme (UKCIP, undated), the US National Climate Assessment (NCA, 2014, see figure 28.3 of adaptation as a cyclical process, adapted from a US National Research Council Report of the Panel on Adapting to the Impacts of Climate Change (NRC, 2010)), to name but a few. Aimed at cities specifically, the UN-Habitat's Planning for Climate Change guide presents the adaptation process as a cycle of nine steps (UN-Habitat, 2014, see figure 2, p.11). The steps or cycle model of climate adaptation suggests a rational approach to decision making, stemming from classical decision theory. It assumes that good knowledge of the problem, the options and the consequences of each option is available or can be readily produced. It is on the basis of this knowledge that decision makers (sometimes in consultation with other stakeholders) can select a course of action. However, it is increasingly recognised that climate change is not the kind of problem that is bounded and comprehensively knowable, and climate adaptation is not a finite set of possible solutions with predictable outcomes, as was suggested in the early definitions of the IPCC mentioned above. Rather climate change and adapting to it is more and more referred to as a complex and wicked problem, fraught with uncertainties, contingencies, feedbacks and value-based contestation, thereby requiring planning, management and governance approaches that are suited to dealing with such realities (Karl et al., 2011; Termeer et al., 2013 and 2016a; Davison et al., 2015). And yet the models of

adaptation currently available still tend to ignore or under-represent these new understandings of the nature of the problem and the decisions that have to made about how to address it. There is therefore a need to further develop our understanding how climate adaptation decisions are actually being made within existing organisations, cities and governance networks, and relate that to how such decision processes could be improved to progressively adapt as changes in the climate, and other aspects of local, regional and global systems, emerge over time. While temporality is implicit in the cycles model with its focus on steps and iteratively repeating a sequence of steps, the adaptation cycles literature pays almost no attention to the temporal nature of the adaptation process. The focus is on the substantive requirements of each step and not on questions of timing and duration.

2.4. Adaptation as learning and experimentation

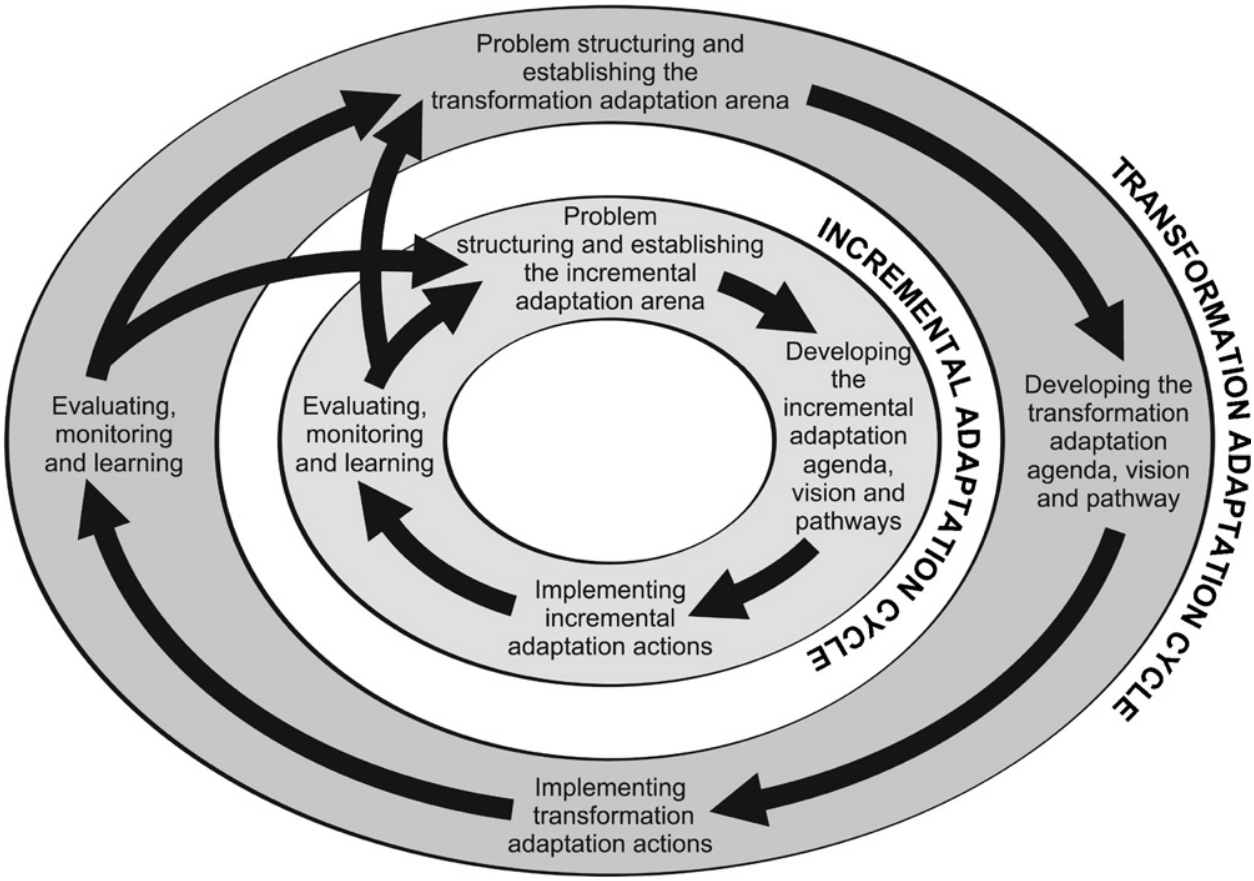
To acknowledge and try to deal with the lack of knowledge and certainty inherent in climate adaptation, particularly adaptation aimed at anticipating and preparing for future projected climate changes, some scholars have introduced the idea of learning, and particularly social learning, into the adaptation assessment, planning and management process (Pahl-Wostl et al., 2007; Pelling et al., 2008; Pahl-Wostl, 2009; Tschakert and Dietrich, 2010; Tabara et al., 2010; Pelling, 2011). Often this learning is also reflected as cyclical in nature, depicted as iteratively repeating the cycle having gained more knowledge, experience and understanding of the process itself. This emphasis on learning as a core dimension of adaptation has led to much more focus and research on the monitoring and evaluation step in the cycle, which is increasingly referred to as the monitoring, evaluation and learning step, and on distinguishing between incremental and transformative types of adaptation (Pelling, 2011; Parks et al., 2012; Termeer et al., 2016b). Some scholars have focused on experimentation, as one form of learning, critically examining and arguing the importance and effects of having spaces to develop and test

alternatives, and the formation of networks to spread ideas, technologies and approaches to replicate, scale up and scale out what works (Bos and Brown, 2012; Bulkeley et al., 2014; Anguelovski, 2014; Patel et al., 2015). There has been a confluence of climate change research with innovation and design thinking, which resonates strongly in the urban space where urban designers, architects and the business community have a strong affinity for ideas and practices of experimentation, prototyping, innovation and design (while the notion of adaptation holds far less currency within these communities).

A few adaptation scholars have researched and written about the existence and importance of shadow spaces, shadow networks and the work of policy entrepreneurs and adaptation champions, drawing attention to the informal and relational aspects of the adaptation process, especially when it comes to learning and experimentation (Pelling et al., 2008, Leck and Roberts, 2015). However, these ideas and empirical findings are poorly reflected in current theories and models of the adaptation process. The closest is possibly Park et al.'s (2012) attempt to extend the adaptation cycle model to account for ideas of learning and the distinction yet relationship between incremental and transformative types of change, by creating the Adaptation Action Cycles framework. Park et al. (2012) propose and validate a conceptual framework for understanding the process of adaptation made up of two distinct yet interconnected action learning cycles operating at different scales, see figure 1 below. Both cycles involve four steps or what the authors refer to as activity clusters, namely: structuring the problem and establishing action arena; developing the agenda, vision and pathways (i.e. sets of measures and initiatives); implementing actions; and evaluating, monitoring and learning from the actions and outcomes. One cycle, operating at a smaller scale, involves incremental adaptation actions aimed at maintaining the current system. The larger-scale cycle entails transformative adaptation actions that aim to disrupt and fundamentally change the system into something new. A shift between the two cycles, from incremental to transformative or the other way around, is suggested to be possible (not always, but

in particular places and times) when transitioning between the evaluation and learning step and the step of (re)structuring the problem and (re)establishing the action arena. While the four steps are common between the two cycles, Park et al. (2012) propose that the information, knowledge, skills and decision support required for each cycle are quite different based on the aim to maintain the status quo or to trigger a rupture and drive systemic change. However, questions of timing and the duration of the steps and cycles are again underdeveloped.

Figure 1: Park et al.'s (2011, p. 118) Adaptation Action Cycles framework



2.5. Adaptation as pathways

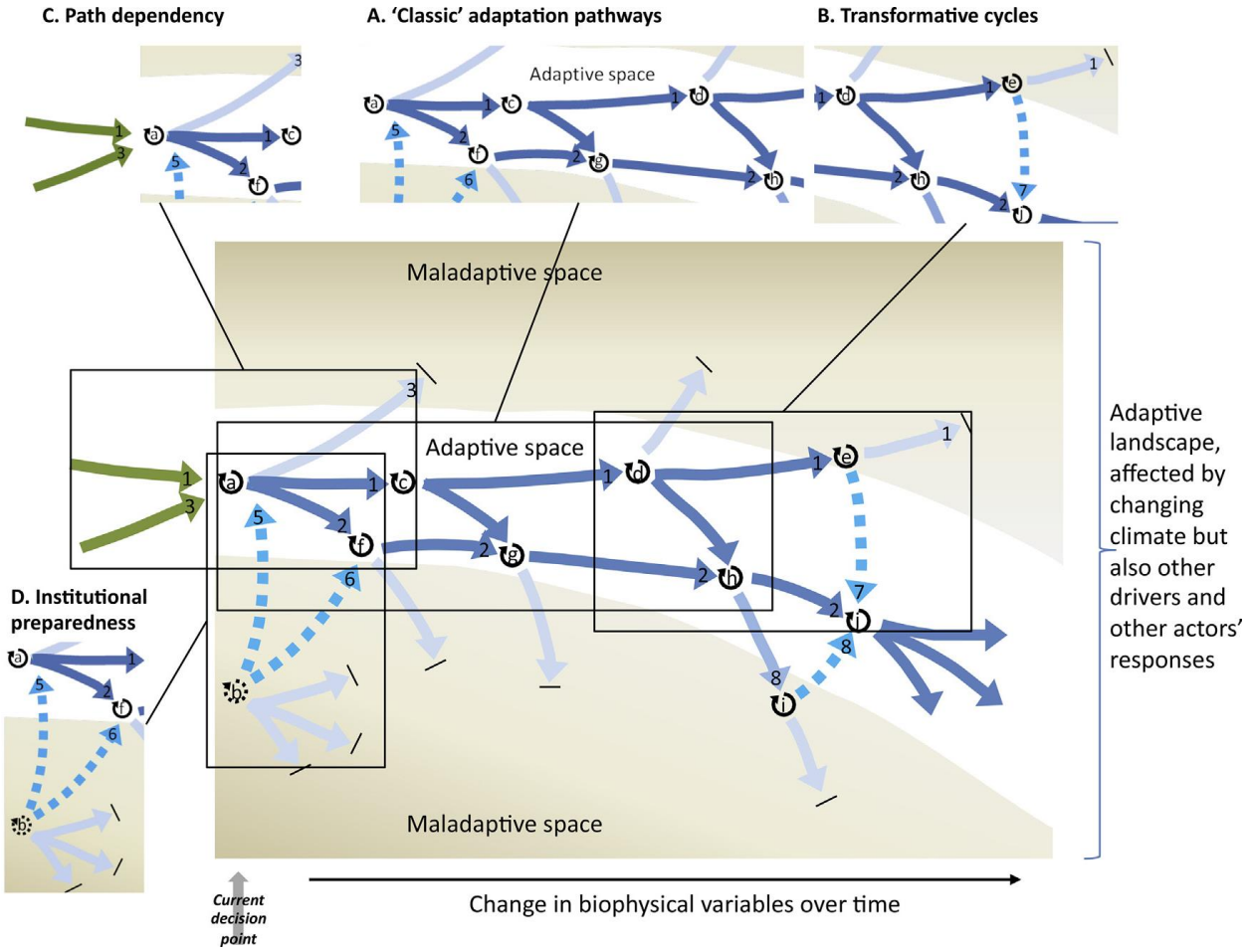
As an alternative to the cycle model of adaptation process, the notion of adaptation pathways has emerged in recent adaptation literature. An adaptation pathway has been defined as the sequencing of

decisions to select and implement climate adaptation measures over decadal timescales so as to balance irresolvable uncertainty with an imperative to avoid both unacceptable levels of risk and what may be deemed excessive or wasteful expenditure (Reeder and Ranger, 2011; Rosenzweig and Solecki, 2014). Or as Haasnoot et al. (2013, p.490) succinctly put it, an adaptation pathway is "*a concatenation of actions, where a new action is activated once its predecessor is no longer able to meet the definition of success*". The concept of adaptation pathways has mostly been used in a forward looking sense at what future adaptation actions may be deemed technically robust and socially acceptable under various scenarios, specifically in London focusing on sea level rise and flood risk in the Thames Estuary (Reeder and Ranger, 2011; Ranger et al., 2013), sea level rise and flood risk in the Rhine Delta (Haasnoot et al., 2013) and various climate risks in New York City (Rosenzweig and Solecki, 2014). The future scenarios account, to varying degree, for uncertainties pertaining not only to the evolution and local manifestation of the climate system, but also to the uncertainties regarding future economic, political, technological, demographic and other environmental trends (Haasnoot et al., 2013). The pathways identify decision triggers and tipping points such that new options can be selected with sufficient lead times when the existing options no longer limit risk to an acceptable level, while aiming to avoid maladaptation.

Wise et al. (2014) critique earlier work on adaptation pathways as not adequately accounting for the social and institutional aspects of decision-making processes. They draw attention to the decision context within which the adaptation agenda is situated, promoting careful consideration of the complexities and uncertainties pertaining to: (1) knowledge of the system in question that is being developed, managed and adapted; (2) the goals of any policy or actions; and (3) the distribution of power in decision making and implementation. As such, Wise et al. (2014), like Park et al. (2012) in the Adaptation Action Cycles framework shown in figure 1, suggest it important to distinguish between two levels of adaptation: (1) incremental actions within the prevailing governance regime that address proximate

causes of vulnerability or developmental needs and (2) transformative adaptation that entails changing the rules and values that frame decisions and assign power in the decision process to produce a more just and fair society in light of global environmental change (transformative segments of an adaptation pathway are depicted as dashed arrows in figure 2 below). Wise et al. (2014 p.332) argue that socio-institutional enablers and constraints need to be better understood in order to progress adaptation, pointing to the importance of historical context and suggesting that "*the current status of the system and its future trajectory are heavily influenced by the past*". They argue that it is important to look back at past decision making, what they refer to as an 'antecedent pathway' (depicted as green arrows in figure 2), as a basis for charting a possible or likely set of future adaptation pathways. This antecedent pathway provides an indication of 'institutional preparedness' for future climate adaptation. It is when institutions are not prepared to enable the social processes needed to realise a fairer and more sustainable society that incremental adaptation is deemed insufficient to address the root causes of climate risks and transformative types of adaptation are necessary (Wise et al., 2014). Questions of sequencing and the temporal evolution of climate adaptation actions and interventions are thereby more clearly brought into focus by the pathways model.

Figure 2: Wise et al.'s (2014, p.333) depiction of a decision-maker's adaptation pathways



Most recently, Gorddard et al. (2016) have further built on the reconceptualisation of adaptation pathways offered by Wise et al. (2014), suggesting that it is insufficient to only focus on decision-making processes. Rather, they argue, the broader decision context needs to be understood by analysing the social systems and structures affecting the framing of problems and the agency of different decision makers and stakeholders in a decision-making process that in turn limit or create the ability to innovate and change. Gorddard et al. (2016) propose and test a framework for analysing the interrelations between values, rules and knowledge that shape the decision contexts within which decision are made.

Dealing with uncertainty and imperfect information and knowledge is central to the adaptation pathways framework or model. It combines technical approaches to risk management with social dimensions of decision making and governance, to be used either as a foresight and planning tool or as a retrospective analytical tool. Building on the foundational work in London, the Rhine Delta and New York, mentioned above, the adaptation pathways model has been revised and applied in Australia to sea level rise, storm surges and flood risks in Lakes Entrance (Barnett et al., 2014), to risks of droughts, floods, salinity, and overexploitation in the Murray-Darling Basin (Abel et al., 2016) and coastal management in Victoria, Queensland and Tasmania (Gorddard et al., 2016).

2.6. Adaptation as a governance challenge

The adaptation cycle and pathways models have emerged primarily from the fields of planning and management with a strong technical dimension, focusing on what decisions need to be taken, and a fairly weakly developed understanding of the social and political dimensions of how adaptation decisions are taken in contexts of high uncertainty and contestation. Developing largely in parallel with the planning and management strands of the adaptation literature is research into the governance of climate adaptation, which also deals with adaptation as a process but with a much stronger and broader socio-institutional perspective on decision making. Governing is defined as directing the interactions between and actions of public and private actors to solve societal problems and/or create societal opportunities using different instruments and forms of coordination (Termeer et al., 2011; Huitema et al., 2016; Knieling and Klindworth, 2016). Governing entails creating institutions, rules and organisations, establishing the normative basis to guide problem solution and institution building, and making choices about problem definitions, jurisdictional levels, policy instruments, timing and financing of interventions, and mechanisms for implementation and enforcing compliance (Huitema et al., 2016). The governance

system, or regime or configuration, thereby characterises the ways and means by which the diverse values, interests and preferences of various private and public actors come together and combine to direct choices, actions and interactions toward the realisation of collective goals. As Termeer et al. (2011, p.160) point out: "*This broad definition comprises governing activities of governments, businesses, and civil-society actors; it encompasses economic, communicative, and regulatory steering mechanisms; and it embraces both structure and process*."

Linking this understanding of governance to the definition of climate adaptation discussed in section 2.2, research on the governance of urban climate adaptation thereby deals with questions of: how the problem of adapting to changes in the climate is and can be framed; who is and needs to be involved in directing climate adaptation; what rules and organisational structures and mechanisms exist or could be established to facilitate interactions, make decisions and take actions to adjust the city system(s) to moderate or avoid harm or exploit beneficial opportunities posed by actual or expected climate conditions and its effects; and what norms and values are being, and could alternatively be, brought to bear on the choices to be made. While the city is the primary scale of interest, the governance literature draws attention to the multiple other scales (and/or levels) of decision making, action and interaction that have a bearing on what happens at the city scale (Bulkeley, 2013; Vedeld et al., 2015; Termeer et al., 2016a). Huitema et al. (2016) argue that it is productive to investigate the design of climate adaptation governance systems, operating across scales, by focusing on governance choices. Both choices that are explicitly made by actors to address climate adaptation problems and choices that emerge through complex political and institutional processes. They suggest a typology for mapping and describing such choices consisting of: problem choices; level choices; timing choices; modes of governance and policy instrument choices; norms and principles choices; and implementation and enforcement choices. Giving particular attention to the choice of governance modes and instruments to address climate change in cities, Bulkeley (2013)

and Knieling and Klindworth (2016) distinguish a number of governing modes on a continuum from hierarchical relationships based on centralised authority, dependency and guidance using mainly regulatory instruments, through networks of actors based on trust, interdependency, collaboration and voluntary self-regulation, to market-oriented relationships favouring independence, competition and incentive-based instruments.

Recent research shows the central role that government, and particularly local government in the context of cities, plays in governing climate adaptation and thereby in making many of the types of choices just mentioned (Lundqvist, 2015; Boyd and Juhola, 2015; Huitema et al, 2016; Mees, 2016). This central role for local government in adapting cities to a changing climate is due to the need to coordinate between local initiatives, private actors and other levels of government in order to achieve collective adaptation objectives, such as flood protection, food security and disease prevention, and ensure procedural and distributional justice in the pursuit and realisation of those objectives. However, Huitema et al. (2016), in reviewing the contributions to a Special Issue of Ecology and Society on The Governance of Adaptation, find that governments do not always see a task for themselves, mainly because of being so focused on the present and not being exploratory in nature, rather taking a wait-and-see approach to climate adaptation. A small yet growing number of countries are establishing laws and/or policies directly targeting climate change (Biesbroek et al., 2010; Kehew et al., 2013). While most highlight a key role for local governments, especially in cities, few national policies go beyond a sector-based approach that fails to address the complexities and inter-connections characteristic of climate change risks, impacts and adaptation in urban areas (Kirshen et al., 2008). An increasing number of cities globally have adopted a strategy and/or plan laying out a set of objectives, targets and measures for addressing climate change (Birkmann et al., 2010). Many of these strategies and plans, especially the first generation established in the early- to mid-2000s, are dominated by mitigation efforts to reduce greenhouse gas emissions from

cities. This echoes the early emphasis on mitigation in the international climate change negotiations. Attention is beginning to shift to climate change adaptation, not only for cities in developing country contexts but also those in high-income countries where there is increasing concern over the levels of exposure of people and infrastructure to climate-related extreme events and the costs associated with damages caused by such events (Noble et al., 2014). There is much momentum gathering around the call for cities to lead the way in driving climate action, in terms of both mitigation and adaptation, instead of waiting for international agreements to take effect.

A growing number of city governments have begun taking steps to understand the local climate-related risks they face, plan possible interventions for reducing these risks, and some have begun implementing a number of climate adaptation measures (Birkmann et al., 2010; Carter, 2011; Hardoy and Romero-Lankao, 2011; Hunt and Watkiss, 2011; Carmin et al., 2012a and b; Anguelovski et al., 2014; Rosenzweig and Solecki, 2014). However, many cities face considerable barriers when attempting to make adjustments in light of changing climate conditions. A growing body of research within the adaptation governance literature seeks to identify such barriers (Roberts, 2008; Winsvold et al., 2009; Burch, 2010; Funfgeld, 2010; Storbjork, 2010; Measham et al., 2011; Satterthwaite, 2011; Leck at al., 2011; Berkhout, 2012; Runhaar et al., 2012; Ziervogel and Parnell, 2012; Clar et al., 2013; Ekstrom and Moser, 2013; Pasquini and Shearing, 2013; Uittenbroek et al., 2013 and 2014; Biesbroek et al., 2014a and b; Ziervogel et al., 2014a; Leck and Roberts, 2015; Lehmann et al., 2015). Reading across this body of literature suggests that some of the most common and pernicious barriers to climate adaptation relate to:

- securing political commitment for climate adaptation;
- operating within an organisational culture that stifles innovation, collaboration and learning;
- competing short-term priorities and interests;

- coordinating and allocating responsibilities between local, regional and national levels of government;
- coordinating and collaborating between government, private and civil society actors; and
- reorienting existing funding and resources or accessing new financial flows for climate change adaptation.

It is these types of barriers that exist within many current urban governance systems that block or hinder the climate adaptation process, be it a cycle, a pathway or otherwise. However, there is still much work to be done to address the call made by Biesbroek et al. (2013, p. 1119) to "*go beyond asking the questions of 'if' and 'which' barriers to adaptation exist and begin asking 'how' and 'why' barriers emerge*". This is where further research into climate adaptation governance and decision making can offer new insights as a basis for improving conceptual models of the adaptation process. It is here that this thesis makes a contribution. Huitema et al. (2016, p.4) point out that the debate on climate adaptation governance "*does not have anything that even closely resembles an agreed conceptual framework*". There is, therefore, much work to be done. This thesis constitutes one small yet hopefully significant contribution.

2.7. Conclusion

Based on this review of the climate adaptation literature, particularly that dealing with climate adaptation as a process and a governance challenge, it is clear that very little of the research focuses at the city scale and very little deals directly with contexts outside of the Global North where levels of wealth, governance capacity and the coverage of formal legal, policy, planning and management systems is high. What also emerges from the review is that temporality is insufficiently dealt with in studying climate adaptation, beyond regular reference to the significance of dealing with uncertainty regarding the future

and the mismatch between the long time-frames at which climate change occurs and the short political cycles and profit cycles that dominate public and private decision making respectively. The significance of spatial scales has received increasing attention over recent years within scholarship on the social dimensions of climate adaptation, particularly the multi-level governance literature, but the same cannot be said of temporality. The temporal aspects of adaptation are important to better understand because they have a strong bearing on how adaptation processes are designed, planned, implemented and resourced. Just like discussions on the spatial and territorial scales of climate adaptation are central to divisions of power and responsibilities for shaping and driving processes and outcomes, so temporal scales speak to issues of creating windows of opportunity for introducing changes and sustaining action such that outcomes can be secured. Climate adaptation scholarship needs conceptual models that more robustly address the temporal aspects of the interactions between the decisions and actions being taken by those shaping climate adaptation in cities. The lack of climate adaptation scholarship dealing with the city scale, the global South and temporality represents a significant knowledge gap, undermining the robustness and applicability of existing theories and models of climate adaptation.

At this juncture it is important to note that the literature on climate adaptation in cities (and climate resilience where it is used as a proxy for, or interchangeably with, climate adaptation) reviewed in this chapter is positioned alongside research being done in the fields of urban sustainability, urban risk and disaster management, urban resilience and urban planning, each of which tackle similar questions and debates from slightly different angles. While there is cross-fertilisation of ideas and methods happening between them, these remain somewhat distinct research communities and fields of inquiry, so the work being undertaken in these cognate fields are not fully represented in this review. For the purposes of conceptual clarity it is necessary to briefly tackle the thorny issue of definitions. As discussed in section 2.2., this study uses the definition of adaptation provided by the Intergovernmental Panel on

Climate Change (IPCC, 2014). Similarly, when referring to resilience the IPCC (2014, p.127) definition is invoked, which is "*the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation*". While there is strong complementarity, and even much overlap, between the concepts of adaptation and resilience as used in the fields of climate change research, policy and practice, adaptation foregrounds responding to climate stimuli while resilience foregrounds the systemic nature of dealing with any or all disturbances whether biophysical, economic, social or otherwise.

Before turning to methodological issues of how to approach the empirical requirements of such research, the next chapter reviews the theoretical development of decision-making models outside of the climate change adaptation literature, primarily in the field of organisation studies. This is done in an attempt to find additional or alternative concepts that have not yet been used, but might assist, in analysing and better understanding processes of urban climate adaptation.

Chapter 3: Theorising decision making

3.1. Introduction: decision making as a process

This thesis investigates the proposition that urban climate adaptation can be better understood as a process of decision making. Decision-making processes are inherent to governing, policy-making, planning, resource allocation, experimentation, knowledge production, implementation, evaluation and learning, all of which are part of adapting a city to changes in the climate. Within the field of organisation studies much research has been focused on understanding decisions and decision making, i.e. the process of choosing a course of action for dealing with a problem or opportunity (Schermerhorn et al., 2003), or making "*a choice among alternatives that will yield uncertain futures, for which we have preferences*" (Howard, 2007, p.37). Having reviewed the literature on climate adaptation in the previous chapter, this chapter looks to the field of organisation studies to determine what conceptual models have been developed through the study of other policy domains that may offer new insights for understanding how climate adaptation is undertaken in cities.

Broadly there are two approaches to organisational decision-making research: content research and process research (Elbanna, 2006). Content research focuses on the options that are being decided upon, while process research focuses on how a decision is taken and what factors shape the decision and its outcome. Both are very relevant to the field of urban climate adaptation, where numerous actors make choices about what to do to address changing climate conditions, as one of multiple decision-making factors and objectives, in the face of considerable uncertainty and a diversity of values and preferences. As laid out in the previous chapter, relatively more attention and emphasis has to-date been placed on the content aspects of urban climate adaptation. As such, the second strand of the organisational decision-making literature, focusing on process, holds promise for providing conceptual and

methodological tools to address some of the shortcomings currently evident in the climate adaptation literature, as highlighted in section 2.7. The chapter begins by sketching out the key features of decision theory and then describes three conceptual models of organisational decision making in the public sector, drawing primarily on the work of Teisman (2000).

3.2. Decision theory

Decision theory offers a number of models for how decisions are made within an organisation. Classical decision theory assumes complete knowledge and certainty regarding the nature of the problem or opportunity, the possible options or alternative courses of actions, and the consequences associated with adopting each of these options. Classical decision theory gave rise to the rational model of decision making in which logic is applied to select the optimal choice that maximises value in attaining a clear goal and set of objectives (Simon, 1977). Within this model, alternatives are systematically identified, criteria are established based on a clear and universalised set of preferences or utility functions, options are ranked and a selection is objectively made. This model does not account for diversity and contestation over either the nature of the problem, the goal and objectives of intervening or value attributed to the options. The rational model, while widely recognised as overly simplistic, is seen as being somewhat applicable in decision contexts where there are high levels of certainty and consensus over the nature of the problem, the set of feasible solutions and both the likelihood and preferences for various outcomes. These sorts of decisions can be expert led and authoritatively taken. Climate change has clearly been shown not be a problem of this nature. Instead climate change is widely recognised as a wicked problem (Karl et al., 2011; Termeer et al., 2013; Vogel et al, 2016). As uncertainty and contestation grows, the hallmarks of a wicked problem, so the need for collective bargaining in the pursuit of a sufficiently acceptable choice becomes necessary. Consequently, behavioural decision theory has developed.

Behavioural decision theory is based on recognising that decision makers have bounded rationality rather than perfect knowledge, meaning that they only partially perceive the nature of the problem or opportunity being addressed, the range of possible options and the implications of adopting each option. This perception will not be common within a group but rather individuals will hold different information, values, preferences and views within the decision making process. As such, decision makers seek a broadly acceptable or satisfactory choice using judgment over logic aimed at optimisation. This theory gives rise to a number of decision models, based on the levels of uncertainty regarding the problem and possible courses of action, and the nature of the organisation. One is the administrative or organisational procedures model in which decision making is understood to be an aimed at 'satisficing' rather than optimising, that is finding the first alternative with acceptable value (i.e. the good enough option) rather than the option with maximum value (i.e. the best option). Recognising that decision makers within organisations have bounded rationality, organisations are not seen as singular entities but rather constellations of loosely allied units. Problems being dealt with by the organisation tend to be broken down and assigned to specialist units, which develop their own sets of goals (or sub-goals within the organisation), priorities and knowledge bases. Because these units have many demands placed on them, with limited time and resources at their disposal, they look for shortcuts for finding acceptable solutions, referred to as Standard Operating Procedures, that are applied to similar types of problems. Over time these units are thought to become more distinct as sub-goals are entrenched, placing strain on the alliances between the units of the organisation, sometimes resulting in a situation referred to as organised anarchies (March, 1988). This has led to the development of the political model of decision making.

Sometimes referred to as the incrementalist model, the political model of decision making views decisions as a result of bargaining and compromise (Elbanna, 2006). This model emphasises the multiplicity of goals, values and interests at play within an organisation, in part due to the complexity of the environment in which it operates, and thus suggests that decisions are not focused on one issue or problem, but rather many problems and/or opportunities reflecting the sub-goals of units within the organisation and personal goals of decision makers within those units. Coalitions form on the basis of shared interests and/or reciprocal support and decisions are arrived at through conflict resolution and consensus building until a broadly acceptable compromise is reached (Pfeffer, 1981). Consensus building tends to result in incremental changes in the course of action as parties veto novel or radical alternatives proposed by the opposition and creates a number of implementation challenges (Nutt, 1999). The political nature of decision making leads to the distortion of information, restricting the flow of information, the exclusion of viable alternative options that do not align with powerful interests, and a skewed emphasis on internal positioning and power plays over external feasibility factors (Elbanna, 2006).

A third model proposed within behavioural decision theory is widely referred to as the garbage can model (Cohen et al., 1972). This model emphasises the fragmented and chaotic nature of decision making within organisations. Rather than the deliberate manipulations implied by the political model, the garbage can model suggests that problems, solutions, participants and choice situations are tossed together and combined in the organisational garbage can and a set of random and unsystematic decisions result. As such, decision making is seen as a stream of events rather than a defined problem and solution set, within which many problems go unsolved and implementation often proves challenging because different people with different interpretations are involved, who were not central to making the choice.

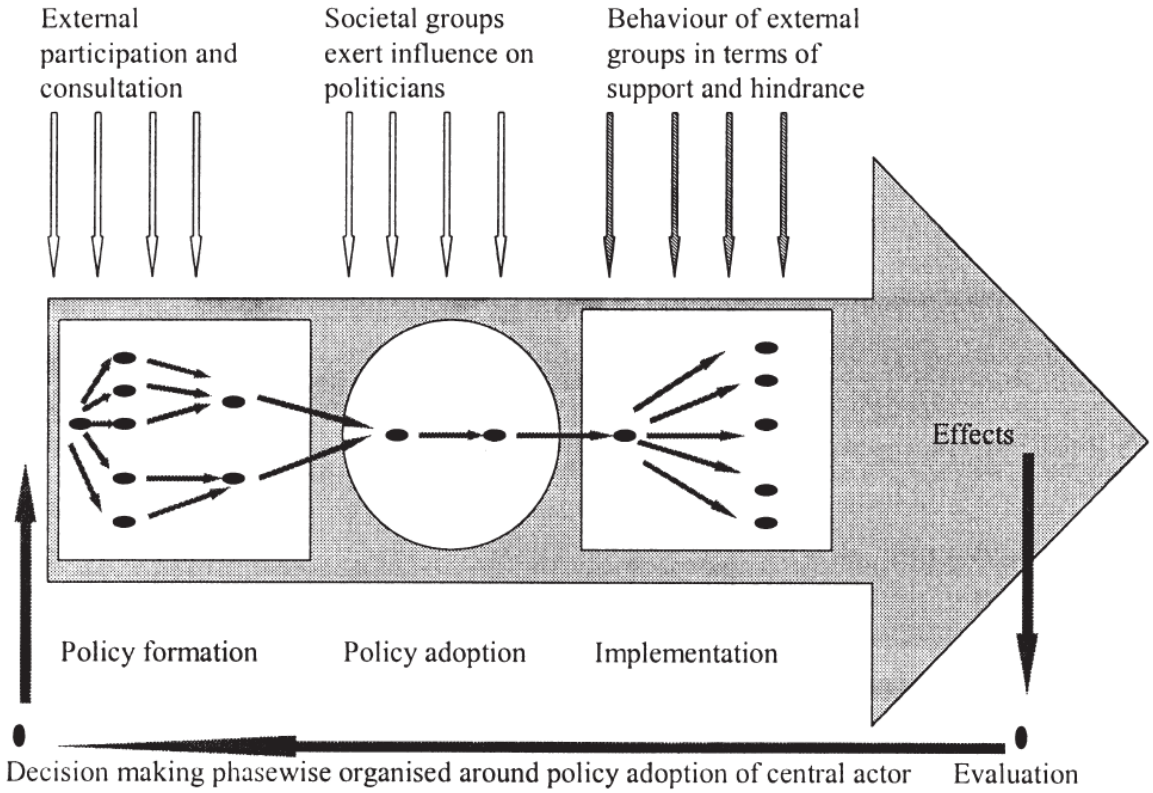
3.3. Models of organisational decision making

The foundational theories and models of decision making introduced above have evolved over the last five decades through a growing body of organisational decision-making research. Teisman (2000) sets forth that, while many theories have been suggested for understanding decision-making processes, ultimately there are three general models of complex, collective decision making that underpin these theories. The first is the phase model, used to analyse decision taken by a focal actor by focusing on "*successive and distinctive stages in a process*" (Teisman, 2000, p.937). The second is the streams model that focuses on the linkages between various actors, problems and solutions that exist and operate concurrently, giving rise to decisions. The third is the rounds model that combines elements of both other models, focussing on successive and concurrent decision making respectively, to explain decision making as progressive interactions between combinations of actors, problems and solutions. These three models are based on different assumptions that guide the empirical investigation of decision-making processes through the deployment of particular concepts.

3.3.1. Phase model of decision making

The phase model assumes that decision making is problem driven. Problems exist, however complex and wicked they may be, and the first step in a decision-making process is always the identification, definition, formulation and diagnosis of the problem to be addressed. It is only thereafter that solutions are sought, a (central) decision is made, marking the transition from policy/plan formation to implementation (may be signalled by the formal adoption of a policy or plan), and action is taken. Different actors may be involved in each phase, giving rise to varying degrees of contestation and consensus. Ultimately each phase is seen as progressing from one to the next, such that a decision is reached and enacted, and possibly evaluated and revised thereafter.

Figure 3: Teisman's (2000, p.942) depiction of the phase model of decision making



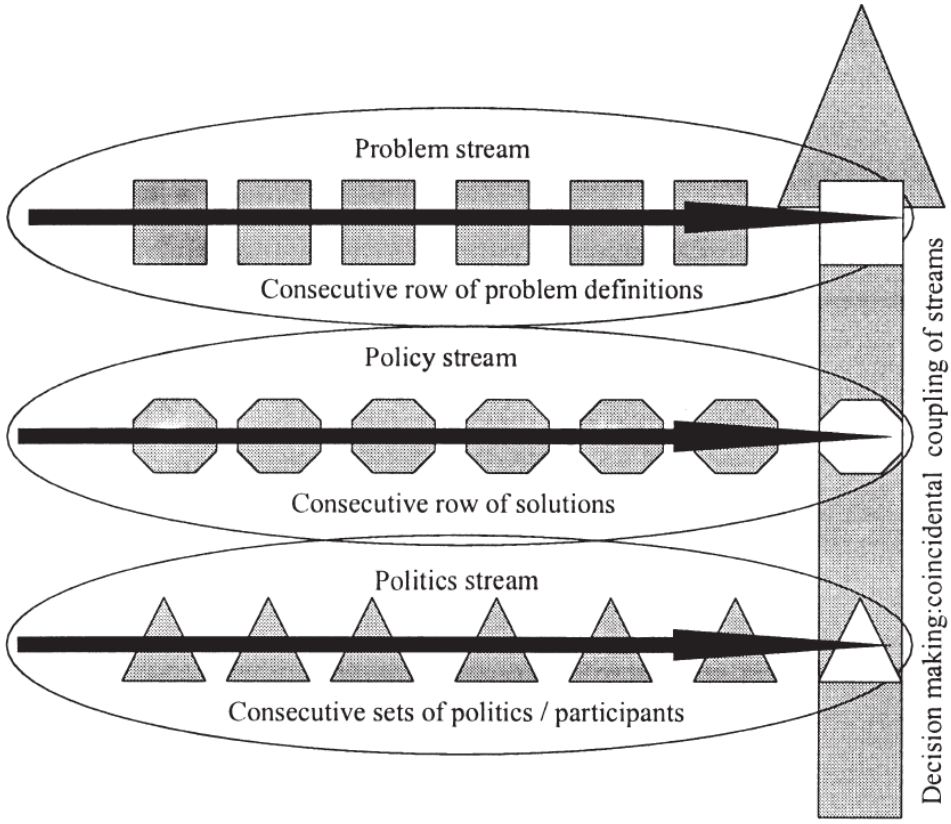
Note: (Grey arrow is decision making; black dots are decisions and dots in the circle represent policy adoption)

Phases or stages of decision making can and are depicted either as linear, unfolding over time, or cyclical, repeating through time. The linear depiction assumes or suggests that the problem and the solution can be adequately identified and formulated at a single point in time and spatial place, while the cyclical version emphasises the need to revisit and revise these over time (and in multi-level governance theories at different spatial scales or territorial levels too). Teisman (2000) notes that analysts using the phase model recognise that in reality the process of decision making is messier than the sequential phases depicted by the model, but chose to use it because it provides a structured and organised approach to both reconstructing and guiding decision-making processes. This model is inspired by and stems from Simon's (1977 and 1979) ideas of rational decision making and bounded rationality. The phase model clearly constitutes the generic version of the adaptation cycle model discussed in the previous chapter.

3.3.2. Streams model of decision making

The streams model, by contrast to the phase model, discounts the idea of temporal sequencing in favour of simultaneousness. Instead of decisions being viewed primarily as unfolding in phases or stages over time starting with a problem, the streams model is based on the premise that numerous and various problems, solutions and actors co-exist simultaneously and decisions arise in moments when the three are effectively linked up. The decision-making process is depicted not as a sequential temporal pattern with a central decision point (usually associated with a central, dominant actor), but as three separate streams that occasionally, under particular conditions (that cannot easily be created or structurally predetermined), coincide to result in a decision.

Figure 4: Teisman's (2000, p.943) depiction of the streams model



Note: (Grey arrow on the right indicates the momentum of decision making as linking three separate streams)

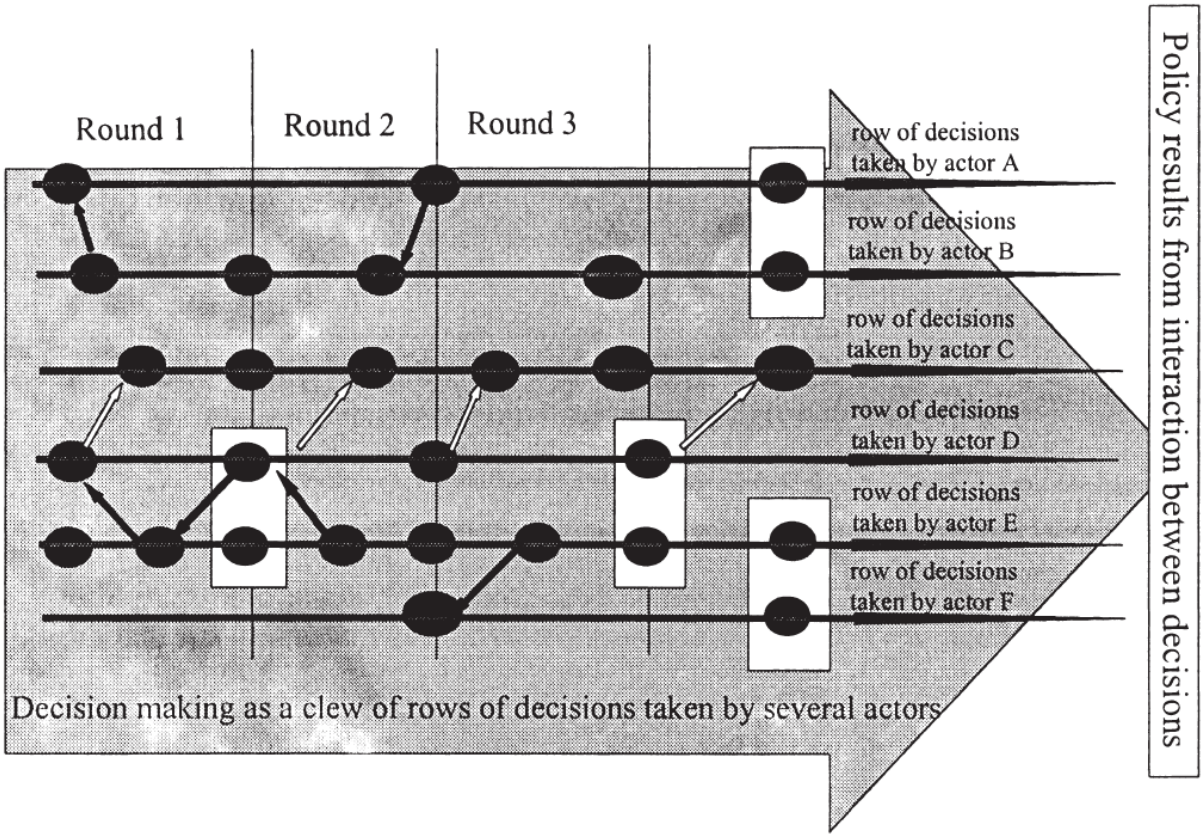
In the streams model, decisions are seen as more political and dynamic (verging on chaotic, inspired by Lindblom's (1959) notion of muddling through) than technical and structured. Kingdon (1984) was the originator and primary proponent of the streams model through his development of the Multiple Streams Framework (MSF) for analysing policy-making processes. The MSF has mainly been used to study agenda-setting under conditions of complexity and ambiguity within the policy-making process, but has been extended to also look at questions of policy implementation. The core concepts of the framework are: streams; policy windows; policy entrepreneurs; coupling; and spillovers. The MSF proposes that policy-making can be understood as consisting of three streams, each composed of various institutional, perceptive and procedural elements: the problem stream; the policy stream (consisting of proposed interventions or solutions); and the political stream (including the 'national mood' and public interest). These streams are said to be largely independent, flowing through the policy system. It is through the work of 'policy entrepreneurs', leveraging opportunities that emerge in 'policy windows', that 'coupling' is achieved between these streams, such that a policy problem, a policy solution and set of responsibilities and governance arrangement are brought into a coherent and compelling whole and thereby successfully arrive on the political agenda to receive attention and resources. Without this coupling, no policy can emerge, such that problems remain unresolved, solutions may exist and be promoted by stakeholders but there is no receptivity for them (Ridde, 2009). Within the MSF, the concept of 'spillovers' suggests that a window of opportunity occurring in a given policy area and being utilised by a policy entrepreneur could increase the probability of another window opening in a related area. It recognises that various actors operate and have power in the different streams. For example, scientists often identify, characterise and explain problems, while engineers and planners focus on potential solutions or interventions and politicians work at capturing public imagination and swaying public opinion. The MSF suggests that policy entrepreneurs can emerge from any of the streams if they have the skills and the resources to draw together elements from across the various streams. The MSF has been applied at various scales, from the

local to the supranational (although largely at the national scale). There are already some early applications of the framework in the climate field, mainly relating to energy (Brunner, 2008; Carter and Jacobs, 2014; Trollip and Boulle, 2016), emergency management (Henstra, 2010) and forest policies (Storch and Winkel, 2013).

3.3.3. Rounds model of decision making

The rounds model focuses on multiple actors, each with their own perceptions of problems and solutions based on particular values or normative preferences, self-interests, resources and capacities to affect the decision outcome. The model depicts the decision-making process as interactions between purposeful actors making a series of smaller decisions through time (characterised as 'rounds' of decision making) that together give rise to an aggregate process of public policy decision making. A round of decision making "*begins and ends with the adoption of a certain combination of a problem definition and a (virtual) solution by one or more actors*" (Teisman, 2000, p.947). As such, this model dismisses the view or assumption that any single, unitary actor can or does make a policy decision at any given place and point in time. Instead, decisions are negotiated outcomes between multiple actors. The model identifies that complications arise in decision making when a solution put forward by one or more actors presents or creates a problem for others, while progress is made in decision making when a solution is identified or designed that addresses the problems and interests of several actors.

Figure 5: Teisman's (2000, p.945) depiction of the rounds model



The rounds model can be theoretically positioned between the structured rationality and synoptic formalism of the phases model, focusing on a central problem, actor or decision-making authority and decision, and the incrementalist muddling through of the stream model, portraying a somewhat fragmented and chaotic multiplicity of actors, problems and actions that coincidentally result in policy decisions. The rounds model emphases the interdependency of actors in arriving at a policy decision and directing a course of action, highlighting the strategic yet protracted nature of public decision-making processes. Teisman (2000) argues that the strengths of the rounds model, over the other two models, are that:

1. It does not *a priori* exclude any actors from an analysis of the decision-making process or assume the centrality of particular actors to the process;

2. It does not assume a single issue being the sole focus of a decision-making process, nor separate, largely independent streams of problems and solutions, but rather looks for dynamic combinations of perceived problems and solutions as linked and represented by particular actors and negotiated between multiple actors as being an acceptable combination of problem(s) and solution(s), i.e. "*none of the definitions are seen as final or permanent*" (Teisman, 2000, p.947);
3. It does not assume that decisions around policy are made at a particular moment in time (e.g. when preceding phases are completed or when stream coincide), but rather that policies result from a series of decisions taken by multiple actors, i.e. rounds of decision making, shaped by the dynamics of combining problems and solutions and the negotiations between the actors, and that policy adoption also involves several rounds of decision making to consolidate and act upon the new stabilised problem-solution combination.

For these reasons "*consideration should be given to the idea of using the rounds model in empirical research focusing on governance. The model offers a way to reconstruct a basically unlimited complexity of events that can be combined into a decision-making process*" (Teisman, 2000, p.949).

3.4. Conclusion

The field of organisational decision-making research yields a number of conceptual models to characterise and explain how problems are addressed, policies formulated and actions guided. Teisman (2000) usefully summarises the models, with their multiple versions, into the phases, streams and rounds models of decision making. Reading across the climate adaptation and decision making literature reveals that the little work that has been done in trying to understand climate adaptation as a process has almost exclusively used the phase model as a point of departure. While there are a few studies in the climate change mitigation field that have applied the streams model to understand and explain progress in

mitigation policy (e.g. Brunner, 2008; Storch and Winkel, 2013; Carter and Jacobs, 2014; Trollip and Boulle, 2016), there are none yet in the climate adaptation literature. There are a very small number of studies that broadly use the thinking of the rounds model (rather than empirically applying the rounds model) to understand and design the governance of climate adaptation in the Netherlands (Termeer et al., 2011; Termeer et al., 2013; Biesbroek et al., 2014a and b). But none of this research has been done at the city scale, in an African context, with a focus on climate adaptation. Hence the contribution of this thesis.

Because the approach to decision making is so central to climate adaptation, which is all about managing a changing climate through flexibility, learning and adjustment, it is necessary to better understand the organizations within which such decisions are taken and enacted. In the following chapter attention turns to the methodological approach taken to empirically study the process of climate adaptation at the city scale as led by local government. The chapter discusses how embedded research within a city government, using a blend of ethnographic and case study research methods, offers a means of getting close enough to gather data and better understand decision-making processes relating to climate adaptation.

Chapter 4: Methodological approach to conducting embedded research on climate adaptation decisions

4.1. Introduction: getting inside local government to understand urban climate adaptation

This study aims to better understand how climate adaptation is undertaken at the city scale. More specifically, the study develops a contextually rich understanding of how local government goes about mobilising and institutionalising climate adaptation in both a strategic and operational sense. Investigating urban climate adaptation as a process requires a research strategy and set of methods that capture both the temporal and organisational aspects of undertaking adaptation in a given context. Decisions made by, or rather made within, a local government play a significant role in shaping the climate risks and vulnerabilities of a city.

As discussed in chapter 2 when reviewing the climate adaptation literature, an increasing number of studies are concluding that local governments play a central role in governing action on climate change in cities. However, most existing studies deal with local government as one of multiple public and private actors interacting to establish collective goals and direct the actions taken in cities. Local government is viewed from the outside as a singular actor. Efforts to understand what local government is doing on climate change are largely based on analysing the formal documents that are made publicly available plus, on occasion, data collected from selected interviews or responses to survey questionnaires. Yet in order to understand processes of adaptation, and test explanatory models of adaptation and decision making, it is necessary to collect fine-grained data that reside within a large organisation like a local government and is not readily or easily accessible in the public domain.

Further developing the current understanding of adaptation as a process, requires studying the workings of a local government from the inside. This is a need already identified and articulated in the adaptation literature by Pelling (2011, p.65) who calls for "*studies of adaptation to climate change to extend their analysis from the external/public to more internal and private life of organisations of all kinds*". Similarly, Berkhout (2012, p.92) suggests that "*an analysis of organisational adaptation needs to start with the complex reality of organisations themselves, rather than starting with the climate signal and then seeking to trace its influence on organisational behaviour. The analysis needs to be done inside-out, rather than outside-in*". Thus I turned to the field of organisational studies not only for models of decision making, as discussed in chapter 3, but also in search of methods with which to develop a research strategy for studying climate adaptation within organisations. Organisational ethnography and processual case study research were identified as promising approaches to enable studying processes of climate adaptation within a local government. An initiative of the Mistra Urban Futures (MUF) programme created the institutional arrangements within which the application of such an approach became possible in the context of Cape Town, South Africa.

This chapter describes the research approach taken, the rationale for selecting the City of Cape Town (CCT) as an ethnographic field site for studying cases of urban climate adaptation, and the methods used to collect and analyse data on processes of adaptation in Cape Town. It covers how access to and within the CCT local government was negotiated and how adaptation process cases were identified and selected to study in-depth. The chapter ends with a reflexive account of my positionality as an embedded researcher working within the municipal administration of Cape Town's local government.

4.2. Organisational ethnography

Ethnography as a research strategy has developed over many decades within the disciplines of social anthropology and qualitative sociology, yet is increasingly used across a range of other disciplines, including geography. Ethnography refers "*(1) to a set of activities, a way of doing research work 'in the field', and (2) to the product of those activities*" (Hirsch and Gellner, 2001, p.1). Ethnography involves a particular approach to doing research fieldwork, "*the researcher engages with the people being studied, shares their life as far as possible, and converses with them in their own terms*" (ibid, p.1). Ethnography entails thinking about the social practices of a particular setting and writing up research findings to produce a detailed account that describes and explains the observed social structures, conditions, processes and meanings. Herbert (2000) argues that the detailed description of ethnography provides a form of explication, a process for making the implicit explicit, for making the unclear more readily legible to those not directly involved. Ethnography focuses on lived experience, studying people in a particular social setting in order to learn about and reveal the social meanings and social order that underpin their activities (Herbert, 2000; Brewer, 2004).

Ethnography stems from a philosophical position that in order to understand the social system, and people's experiences of it and actions within it, it is necessary to study people in their natural settings rather than conducting experimental manipulation (Brewer, 2004). Ethnography has played an important part in the gradual shift away from positivism in the social sciences, based on a recognition that important insights can be derived from the careful documentation and analysis of research participants' own point of view, in their own terms, without pre-judging what they might say (Hirsch and Gellner, 2001). Within geography, ethnography is being used and further developed to understand relations between socio-cultural and bio-physical systems, with a particular focus on the spatial and place-based dimensions of such systems. A number of geographers, notably Herbert (2000) and Lees (2003), have made the

argument for greater use of ethnography within the discipline, as a methodology for critically engaging with lived experience. Herbert (2000, p.550) points to the unique insights that ethnography offers to the processes and meanings that are "*both place-bound and place-making*", producing, reproducing and sometimes challenging socio-spatial life. He argues that ethnography can thereby "*most brightly illuminate the relationships between structure, agency and geographic context*" (ibid, p.550).

Lees (2003) draws an interesting distinction between two types of ethnography. The first is what she calls "*the traditional social science type*", which involves using multiple methods of data collection to develop a detailed description or representation of lived experience "*as it really is*" (p.109). The second type she refers to as "*critical ethnography*", which focuses on the writing of ethnographies that are not intended to be factual accounts or "*photographic representations*" but rather aim to be sense-making stories based on an interpretation of the inevitably partial facts (ibid, p.109). Lees (2003) promotes the increased use of critical ethnography within urban geography as a postmodern form of geographical expedition that takes seriously questions of situatedness and positionality. She posits that ethnography, through engaging the socially constructed nature of phenomena and the importance of language, addresses the richness and complexity of human life and the ways people interpret and experience the world, while reminding us that the researcher can only ever gain partial insight (ibid, p.110).

In this study, ethnography provides an opportunity to critically engage with the lived experience of city government staff (primarily officials in the administration but also some political representatives in the City Council). The research focusses on lived experiences of working with ideas and practices of climate adaptation within a specific urban place and develops sense-making stories of how climate adaptation is undertaken in a given context. In developing such sense-making stories, it is possible to make

processes of urban climate adaptation more legible to those not directly involved, which resonates strongly with the aims of this research.

As one particular form of ethnography, organisational ethnography deals with the lived experience of organising and being organised in order to develop an understanding of the social processes shaping decisions and actions in an organisational setting (Ybema et al., 2009; Watson, 2012; Rouleau et al., 2014; Wels, 2015). Organisational ethnography has been developed to study and better understand organisations in terms of views, interests and assumptions that manifest in everyday working practices (Hirsch and Gellner, 2001; Brewer, 2004; Yanow, 2012). Organisations, as places or field-sites to conduct ethnographic case studies, are understood as social units within larger institutions that make up society, such as the state, the market, education, religion and civil society, and are distinguishable by their values and practices (Del Casino Jr. et al., 2000). The rationale for focusing a geographic study, aimed at understanding the adaptation of cities to a changing climate, on an organisation is that organisations both internalise and produce socio-spatial relations within their rules, procedures and practices (Del Casino Jr. et al., 2000). Studying the rules, procedures and practices of local government may thereby help to understand the geographic patterns of climate vulnerabilities and impacts that exist within cities, and how these vary through time and space as a result of adaptation efforts.

A study employing organisational ethnography does not begin with specific hypotheses to be tested. Instead it entails entering a field of organisational life with an openness to watch, discuss and learn from what is happening within the organisation in the terms by which people working within the organisation articulate them. As a research approach, ethnographic studies employ a range and mix of methods to collect and analyse data with the explicit aim of triangulation in order to increase the validity of the findings (Brewer, 2004). Within this mix of multiple methods, participant observation plays a central

role. The researcher spends considerable time living or working with and alongside a social group, interacting with the group members while actively observing and participating in their tasks and practices (Herbert, 2000). In addition to extended periods of observation, ethnographies routinely employ a number of other methods, including interviews, focus group discussions, journaling, analysing documents and communication materials of various sorts (Silverman, 2000).

It was with these ethnographic methods in mind that I entered the CCT municipality in April 2012 with an expressed aim to better understand the workings of urban climate adaptation, looking for actions, activities and decision making that seemed to relate to climate adaptation in some way. The application of data collection and analysis methods used in this study are discussed later in this chapter, in section 4.6, after first discussing local government as a field-site for conducting an organisational ethnography, then introducing processual case study research as a complementary approach to organisational ethnography used the design of the study, and discussing the selection of cases.

4.3. Local government as a fieldwork site

To understand the intricacies of how urban climate adaptation occurs, this study focuses on three cases of decision making within one city's local government: the CCT metropolitan local government in South Africa. The selection of the CCT city government is what Brewer (2004) calls theoretical sampling, which is the selection of an optimal case where the processes or phenomena being studied is expected to be observable. In order to study and theorise how urban climate adaptation decisions are made, especially in a city outside of the Global North where most of the existing empirical work on climate adaptation has been conducted, I needed to select a city government where climate adaptation was already well

underway and where access could be negotiated. The reasons for selecting the CCT city government as the field site for this study are thereby partly strategic and partly practical.

Strategically, Cape Town provides a valuable case in which to study questions of climate adaptation and the role of local government in building the adaptive capacity of a city for a number of reasons. Firstly, Cape Town experiences a number of damaging weather and climate impacts currently, notably including coastal damage from storm surges, flooding and health threats from heavy rainfall events, periods of water scarcity from multi-year droughts, and fire hazards under hot and windy conditions (further details are elaborated in chapter 5, also see Tadross et al., 2012). There is a growing sense locally, as communicated by Cape Town's local government and others, that these impacts may worsen into the future unless action is taken. The climate adaptation agenda has therefore been gaining ground in Cape Town over the last decade. Secondly, Cape Town has relatively high levels of urban growth, inequality, poverty, unemployment and informality that characterise all South African cities, and cities of the Global South more generally (Pieterse, 2010a and b; Samara et al., 2013). It is these urban characteristics that underlie high levels of climate vulnerability within the city, generating demand for climate adaptation and raising questions of equity and justice. And thirdly, while Cape Town has a local government that is arguably under-capacitated by international standards in terms of finances, staff and enforcement authority to fulfil its Constitutional mandate, it has nevertheless already been tackling questions of climate change for over a decade. As such, CCT has made early progress on a number of fronts that constitute important aspects of urban climate adaptation (Ziervogel et al., 2010; Ziervogel and Parnell, 2012). Cape Town thereby offers the potential of being a rich source of data for studying processes of urban climate adaptation.

In a practical sense, this PhD project forms part of the international MUF research programme, focused on co-producing knowledge on urban sustainability. Cape Town is one of five cities in the partnership network that constituted phase one of the MUF programme. To develop and implement the local component of the programme, the African Centre for Cities (ACC) at the University of Cape Town (UCT) and the CCT local government[2] entered into a formal knowledge partnership that facilitated the exchange of researchers and officials between the two organisations (Patel et al., 2015; Greyling et al., 2016). I was one of four researchers that entered the CCT in the role of an 'embedded researcher', as PhD students mandated to co-produce knowledge on urban sustainability. While I focused on urban climate adaptation, the other three embedded researchers focused on energy governance, the green economy and the spatial economy of Cape Town respectively. The arrangement was that we would each spend the equivalent of seven months per year for the duration of three years (April 2012 - April 2015) working in and with the CCT on these topics. This work in the field would in turn form the basis of our PhD research. In line with principles of co-producing knowledge (Pohl et al., 2010; Polk, 2015), we entered into the CCT without a predetermined, finely tuned, prescriptive research agenda but rather with a mandate to negotiate and articulate a terms of reference (see Annex 1) that would be mutually beneficial to the international research programme, the local government, the university and our PhD processes. These institutional arrangements laid a firm basis for negotiating access to the sites of decision making that appeared productive to studying urban climate adaptation as a process.

While the CCT provides a fieldwork site of strategic and practical value, it must also be noted that Cape Town presents a number of characteristics that sets it apart from many other South African cities and cities of the Global South more generally. Cape Town is under the political leadership of the national opposition party, the Democratic Alliance. This makes Cape Town a site of oppositional politics reflecting

[2] Referred to henceforth as the CCT

both local and national goals and priorities (Schmidt, 2010). Cape Town currently has a relatively well-functioning local government administration with a track record of sound financial management (OECD, 2008). And Cape Town hosts a fairly large contingent of environmental non-governmental organisations and research institutes, many of which have climate change as a strategic priority. These characteristics all contribute to shaping the ways in which climate adaptation is undertaken in Cape Town and need to be carefully factored in when drawing conclusions of wider relevance and applicability. Cape Town as a city and the CCT as a local government are introduced in greater detail in the next chapter, which provides contextual details of relevance to making sense of the three case studies of adaptation decision making.

4.4. Processual case research

This study is aimed at better understanding climate adaptation at the city scale. Recognising that local government is a key player in this, I trained my attention on the organisational level, trying to understand how a city government goes about adapting the city in light of actual or perceived changes in the climate. In order to understand processes of organisational climate adaptation it is necessary to investigate decision-making processes as the objects of analysis. Organisational ethnography provides a rich set of research methods for engaging with the social and cultural dimensions of the internal workings of local government as a site of climate adaptation decision making. But it provides little in the way of analysing the temporal aspects of specific processes of decision making, which is a central objective of this study. I therefore looked within the methodological literature on organisational studies for an analytical method designed to study process that could prove complementary to organisational ethnography for better understanding the specifics of urban climate adaptation as it is undertaken within a local government. Processual case research emerged as a promising approach.

Processual case research has been an area of methodological development within the field of organisation studies since the 1970s (Hinings, 1997). Also referred to as processual research or processual analysis, it is associated with the development of process theories suggesting various kinds of temporal relationships, either in the form of deterministic phases or models with interactions, feedback loops, parallel paths, non-deterministic branch points and reversals (Langley, 2010). Processual case research builds an understanding of the world on the changing nature of things over time, rather than on the composition of things. According to Pettigrew (1997, pp.337 and 340), one of the method's originators and developers, processual research aims to "*capture the dynamic quality of human conduct in organisational settings*" and "*to account for and explain the what, why and how of the links between context, processes and outcomes*".

The use of case studies, including both ethnographic and processual case studies, as a research strategy, stems from recognising the importance of context in understanding social and socio-environmental processes (Hartley, 2004). As Langley (1999, p.691) says: "*to truly understand how and why events play out over time, we must examine them directly*". This suggests strong complementarity with the focus on lived experience provided by ethnography. In processual case research, like all forms of case study research, a methodological choice has to be made between studying a single case or multiple cases, and between retrospective or longitudinal case studies. Some combination or hybrid of these is also possible but, as Leonard-Barton (1990) cautions, the imminent danger of this methodological choice is the potential to get lost in the data to the point of being unable to discern the process patterns that enable theory-building. A similar warning is given by Hartley (2004) that, while context is critical, a case study should not get lost in the fascinating details pertaining to a particular process in a particular organisation but rather needs to leverage theory in order to describe and explicate phenomena that are of significance in other contexts. Like ethnography, data collection methods used in processual case research tend to be

a mix of observation, interviewing and reviewing archival documents (Dawson, 1997). Langley (2010) provides a useful overview of the strengths and weaknesses of each source of data as summarised in table 2 below.

Table 2: Summary of the strengths and weaknesses of main data collection methods used in processual case research

Data collection methods	Temporal perspective	Content	Limitations
Observation	Present	Evolving patterns of interaction and behaviour	Localised, ephemeral, dependent on the observer, time-intensive
Interviewing	Versatile – linking past and present	Access the internal life of people (e.g. interpretations, beliefs, reactions)	Artificial interactions influenced by impression management, moods, memory lapses and quality of rapport
Documents	Past	Key event chronologies and recorded rationales	Gloss over conflict and complexity

Processual analysis goes beyond mere storytelling, the describing of events and constructing chronologies and case histories, although these are crucial building blocks in applying the method. These building blocks are used to serve a number of analytical purposes (Pettigrew, 1997):

- to search for patterns in the process and compare the shape, character and incidence of patterns between cases;
- to find underlying mechanisms that shape the patterning (such mechanisms may be part of the conscious intentions of key actors, a feature of the immediate or distant context, or elements in the interactive field between process and context);
- to undertake deduction linked to starting assumptions, values and frames of reference that is used to give structure to the data;
- to link the analyses that explain the mechanisms shaping the patterns of the process under investigation with the outcomes of that process.

As Pettigrew (1997: 341) puts it: "*Beneath the surface events and chronology, the process scholar searches for recurrent patterns in the process, for structure and underlying logics. But there is no assumption of predetermined timetables, of ordered and inevitable sequences or stages. Trajectories of strategy processes are probabilistic and uncertain because of changing contexts and human action.*"

Langley (1999) proposed seven strategies for deriving from process data theoretical insights that are accurate, parsimonious, general and useful. The seven strategies are: (1) developing case narratives (or thick descriptions as referred to in the ethnographic literature); (2) quantifying incidents and applying statistical methods; (3) testing alternative theoretical templates; (4) grounded theorising from inductive bottom-up coding of data; (5) visual mapping and graphical representations; (6) temporal decomposition and bracketing of time periods within processes; and (7) case comparisons across time periods within a case, across processes (i.e. between cases) and between cases and *a priori* conceptual frames (Langley 1999 and 2010). As discussed further in section 4.6, this study employs a combination of case narratives or thick descriptions, temporal decomposition and case comparisons between cases and *a priori* conceptual models.

Processual analysis has been applied to analyse and understand strategic change and competitiveness mainly within organisations in the private sector of Europe and North America, but there are a few studies on public sector organisations (e.g. Pettigrew, 1992 and Allison, 1971). Processual case research has not yet been used within the field of climate research, but holds promise for better understanding patterns of decision making that do, could or should include climate considerations, the mechanisms shaping these patterns, and how the sequencing of actions and changes in context interact to produce different outcomes.

Some of the key challenges of undertaking processual case research noted in the literature are that the method requires considerable time commitment to the research process and that it is easy to get lost in and overwhelmed by a mass of data. Related to this, Pettigrew (1997) notes that poorly performed process research stops at presenting a case history without developing analytical themes linking the empirically derived patterns with wider theoretical debates. Langley (2010) surfaces a critique of processual case research as being the limited generalisability (within the positivist paradigm) or transferability (within the constructivist paradigm) of the findings. She notes that attempts to address this concern can take researchers in two different directions, either further abstraction, developing higher-level theoretical constructs that can be tested in other cases, or closer attention to detail in order to provide a sufficiently rich description of the process that a reader unfamiliar with the case can determine to what degree the insights might be transferable to another setting or situation they know well. This study makes use of both these strategies by providing a fine-grained description of the three adaptation process case studies, followed by the comparison of cases and existing models of adaptation and decision-making process to develop and propose a revised theoretical model of adaptation as a process that can be tested in other case contexts.

In sum, processual case research requires input data regarding events, activities, actors and outcomes gathered from documents, interviews and/or direct observation. Outputs from applying the method can be in the form of chronologies, narrative case histories, and graphical visualisations of patterns and linkages using charts, diagrams, tables or conceptual maps. Within these reconstructions, underlying patterns are sought that characterise and explain the process under study. Based on this overview of the method from reviewing relevant literature, the selection of cases and the data collection and analysis methods used in this study are discussed in the next two sections.

4.5. Selecting cases of adaptation decision making

Prior to the start of my posting as an embedded research in the CCT (in April 2012), I spent much of the preceding six months, while preparing my PhD proposal, beginning to familiarise myself with what cities around the world were doing on the issue of climate change and what was emerging in Cape Town specifically on this front. This preparatory desk-based research involved reviewing available published and grey literature and attending meetings, seminars, workshops, conferences and other events related to these topics, for example various Cape Town Climate Change Coalition meetings (September to November 2011), the 17th Conference of Parties to the UN Framework Convention on Climate Change hosted in Durban (November to December 2011) and a Workshop for Early Career Researchers entitled 'Mediating Climate Change in the City: Experimenting with Urban Responses' held at Durham University in March 2012. I reviewed the climate change plans and strategies of cities around the world and read profiles and reports of urban climate change activities that were underway. This began shaping my early ideas of what kinds of decision-making processes and activities cities were engaging in to address climate change and thereby what I might start looking for in the case of Cape Town. This provided useful background when entering and engaging with staff in the CCT, but was not used to preselect case studies, pre-define analytical categories or prepare interview schedules prior to my beginning fieldwork in the CCT local government.

Drawing together research design features from organisational ethnography and processual case research, I immersed myself in the working world of the CCT. After taking up my position of embedded researcher in the offices of the CCT's Environmental Resource Management Department (ERMD), which spearheads work on climate change in Cape Town, I was guided by the Head of Environmental Policy to have introductory meetings with officials across various CCT departments identified as having knowledge, a mandate and/or a track-record of engaging with ERMD on issues of climate adaptation. I was also

provided with access to a number of internal documents that detailed much of the preparatory work that ERMD staff had done, together with a range of other relevant departments, on developing city-wide Climate Adaptation Plans of Action (CAPAs). One of my early tasks working in the CCT was to follow up on these CAPAs, to gather information and report on what progress had been made. It became clear that the CAPAs were the first concerted attempt by the CCT at articulating what climate adaptation might entail at the city scale in the context of Cape Town. This provided a clear basis and impetus for what became the first of the adaptation process case studies developed for this study.

In parallel with developing the CAPA case study, I spent much time researching the CCT's work on coastal management that involved assessing and addressing local sea-level rise risks. This was some of the earliest sector-specific work on adapting to climate change that the CCT undertook. Because it was being led by colleagues in ERMD and supported by research provided by UCT colleagues, I had very close engagement with and access to this adaptation process. It had all the hallmarks of a rich adaptation process case study, including a scientific assessment of observed and projected changes in local sea-levels, the quantification of associated economic risks, the drafting of CCT policy, and development of spatial planning and land use management tools aimed at reducing the climate risks. This research led to me co-authoring a journal article on managing coastal climate risks in Cape Town (Colenbrander et al., 2015) but ultimately to taking the decision not to include it as a case study in this dissertation. The coastal work proved difficult to study because it was an area of very active deliberation and contestation at the time, and within the immediate team of people, that I was working in the CCT. So in many respects the coastal management and sea-level rise work was too dynamic and I was too close to the action to study it at the time. However, my involvement provided me with valuable knowledge and experience that played a large part in identifying and selecting what became the third case study.

The second climate adaptation process within the CCT to become a case study was identified through a source external to Cape Town. Researchers at the Erasmus University of Rotterdam's Institute for Housing and Urban Development Studies (IHS), in the Netherlands, had been commissioned by UN-Habitat to build a better understanding of how climate change can be integrated into urban strategic planning processes. This research was to be used as a basis for developing guidance for other cities. Cape Town, having completed and adopted a CDS in 2012 that included climate change considerations, was selected for a comparative case study analysis, alongside six other cities globally (Ruijsink et al., 2015). Based on my position as an embedded researcher in the CCT, I was recruited to undertake the data collection for the Cape Town case study. This, together with encouragement from my manager in ERMD to move outside of the department to better understand how climate adaptation was viewed and undertaken by others in the CCT, provided the impetus for me to study the integration of climate change into the CDS. Having drawn international attention as an exemplar of mainstreaming climate change into city-wide strategic planning, it made sense to research this process as a case study.

The aforementioned research on the CCT's coastal management and sea-level rise work and my involvement in the final stages of the Cape Town Climate Change Think Tank (see Cartwright et al., 2012a), made me aware of work done by the CCT's stormwater management department to address climate change. This was the only other example of very detailed scientific and technical work going into the development and use of downscaled climate change projections within local government planning and operations. Having spent considerable time working as an embedded researcher within the CCT's environment department, I had gained sufficient familiarity with the way the CCT worked and knowledge of what had been happening to address climate change that I was able to successfully negotiate a stint of positioning or embedding myself within the Stormwater and Sustainability Branch. Relocating to their offices made it possible to undertake participant observation, conduct open-ended interviews and access

numerous documents (many only available in hard copy) as a basis for developing the third case study, focusing on the inclusion of a climate change factor in stormwater master planning.

The doctoral study presented in this dissertation thereby entailed a qualitative approach to the purposive selection of cases for analysis (Gerring, 2008). The CCT was selected as a crucial case. Having undertaken processes of urban climate adaptation for a considerable period of time (i.e. over ten years) and having been internationally recognised in the adaptation literature as a leader in the field, the CCT presents a case that is most likely to display and contain evidence of variables that are influential in shaping adaptation processes and outcomes. The three adaptation processes studied as cases within the CCT context were selected on the basis of being diverse, representing a range of possible adaptation processes that play out in a city. The selection of case studies was not made prior to the research commencing but rather emerged through ethnographic engagements within the CCT as productive focal points for understanding the formal and informal working practices within a local government undertaking climate adaptation.

In retrospect I would select the same set of cases because, in my view, they represent the most well developed instances of climate adaptation within the CCT to-date. Subsequent to my time working in the CCT, three more recent processes that may well provide rich case studies for future research. The first is the development and implementation of the Climate Change Policy (CCT, 2017), formally approved by Council on 27 July 2017. The second is the revision of the CCT's Spatial Development Framework (SDF) informed by a CCT commissioned study to review the first version of the SDF through a climate adaptation lens (CCT, 2016). Consultants were tasked with identifying spatial information and tools needed to support further adaptation, identifying a set of high-level spatial planning and urban design options for climate adaptation, and providing guidance as to how to integrate these into municipal land-use and spatial

development decision making (CCT, 2016). A possible third one to watch for the future could be the issuing of climate bonds by the CCT (Kulick, 2017).

4.6. Data collection methods

Based on combining organisational ethnography with processual case research, the main fieldwork techniques used for data collection in this study are observation, open-ended, semi-structured and key-informant interviewing, and document review. Some focus-group discussions were also convened. Data were collected through a mix of planned and opportunistic encounters. This idea of taking an opportunistic approach is referred to in both the ethnographic and case study literature dealing with research in organisations (Buchanan et al, 1988; Hartley, 2004). The use of multiple qualitative methods was a strategy to access a variety of versions of complex decision making processes and events in order to be able to triangulate data and build up a more valid and robust picture or narrative of the case. The representation can never be completely comprehensive or represent a singular truth, but the broader and more diverse the dataset used to develop the interpretations underpinning the findings, the more defensible the research (Silverman, 2000).

Detailed observations, focusing on how people working within the CCT experience and give meaning to climate adaptation and shape decisions relating to climate adaptation, were documented in a series of research journals, spanning the full duration of my time spent working in the CCT between April 2012 and May 2015. As per the MUF knowledge partnership agreement, this equated to an average of seven months per year for the three years spent located in the offices of the CCT, working on Cape Town specific research tasks of data collection and the preliminary analysis and reporting of research findings, with the remaining time spent at UCT. The time away from the CCT enabled desk-based research tasks of

a broader and more theoretical nature to be undertaken, attendance of seminars and reading groups, participation in conferences and the writing of academic publications. The bulk of time in the CCT was spent based in the Wale Street offices of the Environmental Resource Management Department, with travel to other CCT buildings, most notably the Civic Centre, to attend meetings and conduct interviews in my capacity as an embedded researcher in the MUF knowledge partnership. However, between December 2014 and May 2015 I was given a desk on the 17th floor of the Civic Centre in the offices of the Stormwater and Sustainability Branch to conduct research on the third case study. This involved participating in meetings within the Branch, conducting interviews, locating and reviewing documents stored in the Branch's library and archives, and informally talking with colleagues in the office.

Orientation interviews were initially conducted between April and June 2012 to introduce myself, the aims and modalities of the MUF research partnership and my study more specifically, to learn about the structure and functioning of the organisation, and to get a feel for how various people within different parts of the organisation reacted to the topic of climate change. This orientation exercise was supplemented by looking at organisational charts, especially in the Councillors' handbook (CCT, 2011a), and the structure and descriptions of the organisation's website. Subsequent targeted, yet open-ended, key-informant interviews and focus group discussions were used to gather data on particular dimensions of the cases. Interviews and focus group discussions were conducted with a total of thirty-nine people. Of these, thirty-two were officials working in fourteen departments, three were City Councillors (i.e. local politicians), and four were previous employees or consultants to the city government. A full list of interviewees and discussants is provided in the primary sources section of the reference list. Of the thirty-nine people in total, fourteen people were spoken with twice or more over the duration of the research, some as many as eight to ten times. When working in embedded research mode in the local government offices, it is often difficult to draw a clear distinction between short, open-ended interviews and informal

discussions. There were many instances when I popped into a colleague's office with a quick question or two that had emerged either from an earlier interview or meeting, or from reviewing a document. And many instances when a colleague would come by my office to share a piece of information they thought might be of interest and relevance to my work. These opportunistic encounters, while documented in my research journal, become difficult to quantify. A variety of meetings were attended over the three years spent working in the CCT, notably including planning and project related meetings in ERMD and the Stormwater and Sustainability Branch and meetings of the Economic, Environmental and Spatial Planning Committee (EESPCo), the full City Council, the Cape Town Climate Change Coalition and the Cape Town Climate Change Think Tank.

It took some time of being a participant observer and interviewer in the CCT to establish what types of documents existed that could provide rich sources of data and how such documents could be accessed. The documents analysed included reports to Council and Portfolio Committees, strategies and plans, status reports, meeting minutes, reports from commissioned studies, book chapters and papers (co)authored by officials, copies of email correspondence and PowerPoint presentations developed by CCT employees. A full list of primary and secondary sources is included in the reference list. Often accessing such documents involved identifying, tracking down and asking a person who was directly involved in creating the document or who had the institutional memory to know where it might be stored, either digitally or in hard copy, especially for older documents, documents that were not finalised and/or not shared widely (e.g. early drafts of plans, feedback from reviewing draft plans or commissioned study reports and notes of preparatory or scoping meetings). This required being able to follow up numerous times to identify, locate and ultimately obtain a copy of the relevant document(s). Searching for, locating and viewing the document also relied on being given access to the CCT's intranet under the MUF partnership agreement and being physically located, with a desk and a CCT-issued computer, within the

offices of the CCT's Environment Resource Management Department and Stormwater and Sustainability Branch.

In addition to research journal entries, data from interviews, focus group discussions, meetings and reviewing documents were captured in a series of field-notes, captured in real-time in hard copy in notebooks, and then later transferred into digital format as Word Documents and/or images. Together the research journal entries and field-notes describe the circumstances within which events and conversations played out, what was seen and heard, and initial interpretations of what was seen and heard, which Brewer (2004) refers to as methodological, substantive, and analytic notes respectively. I mostly tried to type up the field-notes within a few days to a week of the event, so as to have the conversations still relatively fresh in my memory. This processing of the data proved useful in revisiting the details and starting to think about the meanings and implications of what I was hearing and seeing. It also provided an opportunity to notice gaps or a lack of clarity requiring more information to be gathered, either from the same source, or looking for other relevant sources. Notes from documents were similarly recorded either as a journal entry or as more detailed lists of points in a MS Word document.

Collecting case-based ethnographic data required navigating and transcending certain boundaries, both physical boundaries, in terms of locating myself inside relevant CCT offices, and temporal boundaries, in terms of engaging in ongoing and unfolding activities and processes while also inquiring about past activities and processes (e.g. preparing the Climate Adaptation Plans of Action), as well as prospective activities and processes (e.g. developing a CCT Climate Change Policy). As Langley (2010) points out (see table 2 included in section 4.4), observing, interviewing and reviewing documents as methods of data collection each have relative strengths and limitations. Observation provides a window on the present to see evolving practices and patterns of interactions in real time, but is time-intensive,

high localised and contingent on the positionality and skills of the observer, as discussed further in the final section of this chapter, reflecting on my own positionality. Interviewing provides a way of accessing people's reflections and interpretations of present and past occurrences, but is subject to the quality of rapport between the interviewee and interviewer. Reviewing documents gives insight into past events, meanings, decisions and rationales. However, as Langley (2010) notes, documents tend to eliminate or down play any conflicts that underlay the preparation of the document and minimise complexity. I found this to be largely true of final versions of documents, especially those prepared for the public domain. But where multiple pre-final versions of documents were available, they provided an insight into where such disputes and contestation lay. These traits strengthened my commitment to using a mix of multiple qualitative methods to develop a fuller, more rounded and nuanced picture and ultimately understanding of the subject matter.

4.7. Data analysis and verification methods

Analysis of the data collected in this study also uses a mix of organisational ethnographic and processual case research methods, as well as applied thematic analysis (Guest et al, 2011). Each of the three case studies were analysed separately to identify themes and temporal dimensions, both in terms of key events and phases of development. Data sources were manually coded and clustered from both a thematic and temporal perspective in order to develop narrative explanations of the cases and ultimately look for process patterns within the case evidence. These process patterns were then viewed in light of four existing models of climate adaptation and decision making proposed in the academic literature to ultimately arrive at propositions for a new, revised process model of the urban climate adaptation. In so doing, this study aims to go beyond description and critique to offer some form of theoretical explanation, although not suggest any potential for predicting urban climate adaptation outcomes. Within qualitative

case study research, this type of explanatory analysis is referred to as process tracing, distinguishing it from covariate analyses that use quantitative techniques (Gerring, 2008; Beach and Pedersen, 2013; Bennett and Checkel, 2015). As Gerring (2008) explains, process tracing entails piecing together isolated observations or case evidence using deductive inferences to make macro-causal claims. Piecing together the evidence is often referred to, especially in the ethnographic literature, as producing a thick description or thick analysis. The three case study chapters could be described as thick descriptions developed from drawing together data gathered through the three primary methods described in the previous section. It is the process of inferential reasoning within and between cases, described in the discussion chapter, that enables conclusions to be drawn from the case studies that may be generalisable. As Hartley (2004, p.325) notes: "*Case studies can be useful for exploring new or emerging processes or behaviours. In this sense, case studies have an important function in generating hypotheses and building theories*".

The avoidance of pre-determined rigid analytical categories distinguishes the ethnographic approach from surveys and structured interviews. So does the investigation of what people do in addition to what it is that they say. As Herbert (2000, p.552) puts it: "*The ability to contrast deeds and words provides ethnography with insights unallowable by any other methodology, even open-ended interviews*". He goes on to explain that ethnography is based on a recognition that meanings of objects and events, of social life, are revealed through actions or deeds as well as words, and that the ethnographer infers and interprets these meanings in building an understanding of the larger system. The study is predominantly inductive in nature, piecing together evidence from the case studies to infer how urban climate adaptation happens and why it happens in that way. In other words, it involved drawing out key features from the happenings in the CCT that may help in understanding how climate adaptation might happen in other cities, particularly cities in the Global South. The piecing together of evidence took on a strong temporal or chronological dimension. This followed guidance provided on conducting processual analysis. As

introduced in section 4.4, Langley (1999) proposed seven strategies for deriving theoretical insights from process data. Within this study four of the seven strategies were employed in the analysis. First, case narratives or thick descriptions were developed for each of the three case studies. Within the CAPA case study, temporal decomposition was undertaken to identify time periods or phases within the process. While developing the stormwater case, temporal mapping was undertaken to depict the sequence of events, engagements and outputs within the decision-making process. Ultimately, the three cases were compared with each other and *a priori* conceptual models to derive theoretical insights.

The question of generalisability often surfaces as a concern pertaining to the use of case studies (O'Riain, 2009; Langley, 2010). Many experienced researchers refer to the need to be both well prepared and flexible when undertaking case studies, such that you have a plan to action, based on a tentative set of research questions and the beginnings of a theoretical framework, but are simultaneously able to deal with, and make use of, unanticipated happenings and emergent insights, allowing for new lines of enquiry (Hartley, 2004; Stake, 1995; Yin, 1994). Ultimately, the quality of a case study is judged upon the presentation of sufficient evidence to support the findings and conclusions reached, as well as a display of having rigorously considered alternative explanations of the evidence. A particular challenge with a single case study is to distinguish what is unique to the organisation from what might be common to other organisations (Hartley, 2004). The processual case study design helps to partially address this challenge by contrasting between three different adaptation processes within the CCT case.

Through the chronological reconstruction and thick description of the decision-making processes, categories or themes began to emerge. This is where doing multiple processual case studies proved useful as striking similarities and differences pointed to the existence of relevant categories that could describe and explain climate adaptation decision-making processes more generally. The focus in the first instance

was to accurately (although inevitably partially) render the main features of the case studies and then, in the second instance, to infer and suggest plausible explanations for why things happened as they did, before finally drawing conclusions about the significance of this new-found understanding. The challenge, as Hartley (2004) drawing on Yin (1994) and Eisenhardt (1989) suggests, is to write up the case studies in such a way as to enable the reader to make their own assessment of the fit or congruency of the research questions, the evidence base, the theory or theoretical constructs, the inferences or claims, and the conclusions of the study.

The MUF knowledge partnership between the university and local government in Cape Town helped greatly in addressing the verification challenge raised by Hartley (2004) and others. The analysis of the three case studies developed alongside the later part of the data collection process in an iterative manner, such that the theoretical development is grounded in the empirical evidence. The context chapter and the three case study chapters were drafted during the time spent working with the CCT. This enabled the text to be reviewed and in some cases even partially co-authored by CCT colleagues. The drafts took on various formats to fit in with the demands and constraints of local government work. For example, much of the text included in the context chapter is drawn from two book chapters that were co-authored with CCT colleagues (Taylor et al, 2016; Taylor and Davies, forthcoming). The fundamentals of the CAPA case study were written up as part of a progress report submitted by ERMD to the CCT's Integrated Development Planning Office. It was also prepared as a journal article submitted to the International Journal of Climate Change Strategies and Management, which underwent two rounds of peer review before being accepted for final publication (Taylor, 2016). An early version of the CDS case study was prepared as a report to the Netherlands-based researchers coordinating the aforementioned UN-Habitat study (Ruijsink et al., 2015). The report was circulated to CCT colleagues who had been interviewed in developing the case study, and the main findings were summarised as the basis for a

presentation given by a CCT colleague on 1 June 2013 at the Resilient Cities 2013 conference, the 4th Global Forum on Urban Resilience and Adaptation, held in Bonn, Germany. The stormwater case study was, on the request of the CCT, written up as text for a brochure to be developed by the Stormwater and Sustainability Branch for purposes of communicating the needs and rationale for addressing climate change within their work to audiences external to the CCT, notably property developers and consulting engineers. The stormwater case was also prepared as a book chapter (Taylor, forthcoming) in an edited volume dealing with the co-production of knowledge relating to climate change in Cape Town between academics and CCT officials. As part of the publishing process, the chapter was reviewed by two senior officials in the CCT's Stormwater and Sustainability Branch, as well as a UCT academic and international academic (based in Norway). In addition to reviewing and co-authoring written texts, the work has been presented to and alongside CCT colleagues, as well as fellow academics and members of the public, in numerous meetings, seminars, panel discussions and workshops. For example, a summary of the main empirical findings from the study was presented, alongside the work of the other three embedded researchers, to the CCT's Economic, Environmental and Spatial Planning Committee (made up of City councillors and senior officials) in April 2015. Broader reflections and lessons learned from working as an embedded researcher on climate adaptation in the CCT were presented as part of a panel discussion closing out phase one of the MUF programme, hosted at UCT in August 2015. Most recently, the findings of this study were presented in a lecture entitled ‘How a complex organisation such as the CCT responds to the wicked climate change problem’, as part of a course on 'Understanding Climate Change in Cape Town' in the 2017 UCT Summer School. These interactions created multiple opportunities to receive feedback and enabled the verification of data and analytical interpretations to occur.

4.8. Embedded research and positionality

To do justice to the practices of reflexive qualitative research, it is important to include in this methodological chapter a section describing and reflecting on my positionality, particularly as an embedded researcher working in the CCT. I began this study in 2011 with a Bachelor of Science and Honours degree in Environmental and Geographical Science and Oceanography from UCT. Subsequent to my initial studies I had six years of experience working in an applied research environment, primarily conducting climate vulnerability and adaptation research for national and international policy-making as an employee of the Stockholm Environment Institute, based in Oxford, UK. My university studies had included a number of urban geography courses, alongside courses in atmospheric science, climatology and oceanography, but my subsequent research experience had focused on studying climate change issues in rural settings and at river basin and national scales. While much of the research I had been part of had a policy orientation, I had never worked on or with local government before. From a methodological perspective, my formal training had been more on the use of quantitative methods within a positivist paradigm, although most of my subsequent research experience had been more qualitative in nature. I began this study with no formal experience or training in ethnography. I did, however, have experience in using case study methods, although not processual case research specifically. The combination of my previous studies and subsequent policy research on climate change gave me a desire to understand more about what was really being done to tackle climate change risks and impacts at the city scale and how this was happening, and a strong suspicion that practice and theory did not align well on this issue, especially outside of cities like New York and London that feature in much of the existing climate adaptation literature.

I had a commitment and openness to collaboratively developing new knowledge based on the practices and experiences of those I worked with and alongside in Cape Town's local government.

However, it would be misleading to suggest that I went into the field devoid of any conceptual tools or filters. Rather I had knowledge of existing theorisations and case studies of climate adaptation and decision making based on reviewing published literature. But, aligning with key principles of ethnographic research, I worked hard to avoid having these existing theorisations pre-determine what I observed, remaining empathetic and honest to what was occurring in the field and open to insights emerging from my progressive socialisation into the working world of the group (Herbert, 2000). I have come to relate strongly to the observation made by Hirsch and Gellner (2001, p.7) that ethnography requires "*a curious kind of cross-eyed vision, one eye roving ceaselessly round the general context, any part of which may suddenly reveal itself to be relevant, the other eye focusing tightly, even obsessively, on the research topic*".

The specifics of this doctoral study were negotiated and reshaped over time, in line with by the mandate to co-produce knowledge provided by the ACC (Parnell et al., 2009) and the MUF programme more broadly (Polk, 2015; Patel et al., 2015). However, despite numerous re-framings and re-articulations the study remained broadly true to the original proposal, anchored in the post-positivist paradigm with a focus on the workings of urban climate adaptation viewed as a social process. As previously stated, the terms of the knowledge partnership were that four embedded researchers would spend the equivalent of seven months per year for three years working with the CCT to co-produce knowledge on issues of urban sustainability that were of mutual interest and concern. The allocation of my time spent working in local government varied greatly throughout the three years, as it did for the other three embedded researchers too. During certain periods it entailed working full-time for months at a time in the CCT attending meetings, perusing primary documents, conducting interviews and observing practices. At other times it was spending months entirely away from the CCT, working at the university reviewing academic literature, organising data, preparing text and participating in seminars and workshops. Yet other times, I spent a day or two per week working in the CCT alternately with days spent at the university.

This pattern emerged based on the ebb and flow of the research and the cycles of work taking place in the CCT. The flexibility was made possible by the trust-based relationships that were built up over time. This led to a mix of immersion and distancing, of scheduled and opportunistic encounters.

As mentioned previously, the bulk of my time in the CCT was spent based in an office of the Environmental Resource Management Department, traveling to other CCT buildings to attend meetings and conduct interviews. Over time I came to recognise the benefits this proximity provided for developing relationships, accessing relevant data and building a rich picture of working practices within the department. Working at a desk in the department made many formal and informal encounters and discussions possible by virtue of crossing paths in the corridor and being invited to a meeting, making a cup of tea side by side, or eating lunch together and sharing stories and perspectives. Being positioned in the office was also critical to accessing numerous files and documents, many only available in hard copy, that present a record of the inner workings of processes, providing multiple versions of reports, planning and policy documents, many with tracked changes and comments included in them, as well as copies of emails and meeting minutes. I also recognised the concomitant limitations of only experiencing the workings of the CCT from within the environment department. Having identified stormwater management as a valuable case to study the integration of climate change considerations in-depth, I used my experience and knowledge accumulated while working with ERMD, with the support and encouragement of colleagues in ERMD, to negotiate a stint working within the offices of the Stormwater and Sustainability Branch. Being positioned in a different building, amongst CCT officials with a different mandate and set of knowledge, skills and expertise to those in ERMD proved very valuable for gathering additional data and developing a broader understanding of how the CCT organisation works. O'Riain (in Byrne and Ragin, 2009) refers to this as an empirical extension of the ethnographic case, increasing the evidence that can be collected and thereby the theoretical insights that can be arrived at. In retrospect, it

would have been beneficial to have been able to spend time working side by side with those in the CCT's GIS and Strategic Information Branch and the Strategic Policy Unit that were particularly influential in shaping the CDS process. However, time and other practicalities did not allow for this and so that case study relied on interviewing and reviewing documents.

On the issue of recording data, some ethnographers speak of their notebooks being obtrusive when interacting in the field (Brewer, 2004), but I never found this to be the case. I did, however, feel that an audio-recorder was obtrusive and noticeably changed the mood and dynamic of the engagement. A few interviews and meetings were audio-recorded, but for the most part audio-recording was impractical, either because of large, noisy venues, the numbers of people involved, the spontaneity of discussions, and the range of topics covered, not all of which are relevant to the study. While all those study participants who I asked to audio-record were quick to give consent, I felt it introduced a sense of distance and formality that accentuated a divide between being a researcher and being a participant, which made me feel uncomfortable and stilted the flow of the discussions. On reflection though, I am keenly aware of the advantages of having the recording after the encounter as a more complete record than written notes of what was said, especially for extracting verbatim quotes to enrich the case studies.

Having engaged with, and been interviewed by, numerous international Masters and PhD students who came to Cape Town to conduct fieldwork on various climate adaptation and climate resilience related issues, I have become keenly aware of the relative depth of knowledge and access afforded me through my participation in the MUF programme and my persistent presence in Cape Town throughout the study. While CCT staff are admirably accommodating of researchers requesting time for interviews, and researchers are adept at tracking down reference materials and gleaning pertinent information, I became increasingly aware of the superficial and repetitive nature of the questions many

ask, the limited number of people that visiting researchers are able to speak with, the limited follow ups they can do, and the inaccessibility of many primary documents. Working as an embedded researcher in the local government through a formal knowledge partnership agreement enabled me to spend more time getting into the complex contextual details and building up relationships with research participants that are necessary for gathering data on aspects of organisational life that are not readily codified and accessible. This increased my confidence in the value of the methods I have employed in this study to gain and contribute new and additional insights into the phenomenon of urban climate adaptation.

4.9. Conclusion

While Teisman (2000), as reviewed in the previous chapter, offers useful insights into the strengths and weaknesses of various decision making models, he is less clear on how to go about gathering and analysing the data required to apply the models. The methods deployed in this PhD study go beyond extractive analysis of decision making to find ways of co-producing knowledge on processes of climate adaptation with the practitioners and decision-makers tasked with implementing climate adaptation at the city scale. This combination of theoretical and methodological developments lies at the heart of the original contribution of the dissertation and points to the importance of the methods as well as the questions pursued.

In sum, the research approach taken in this study is a blend of ethnography and case study methodologies. Participant observation, interviewing and document reviewing were the main data collection methods used, conducted during time spent working as a researcher organisationally embedded in the CCT over the period April 2012 to May 2015. The analysis involved developing chronological case narratives or thick descriptions of three process case studies and the application of

temporal decomposition to understand how urban climate adaptation has played out in the context of Cape Town, South Africa. Ultimately the three cases were compared with *a priori* conceptual models to derive theoretical insights. This can best be described as a contextualist methodology, which Mjøset (2009) defines as being constituted by three basic operations: start with a problem; select a process towards an outcome and define a context in which it takes place; and explain by tracing the process within the context.

In the next two chapters, the scene is set for the three in-depth case studies conducted in the context of Cape Town as a South African city. Chapter 5 characterises the South African city, reviews the national legal and policy framework within which South African city governments are undertaking climate adaptation, and suggests nine challenges facing South African city governments that inhibit the planning and implementation of urban climate adaptation despite a conducive legislative and policy framework.

Chapter 5: South African context for addressing climate change in cities

5.1. Introduction

Human-induced changes in the climate have largely been scientifically observed, identified and modelled at global and national scales. However, climate risks, vulnerabilities and impacts are particularly experienced locally and heavily shaped by local context (Wilbanks and Kates, 1999). As such, the municipal scale at which local government operates becomes critical for assessing patterns of climate risks, vulnerabilities and impacts, and for coordinating and taking action to reduce these through climate adaptation (Hallegatte and Corfee-Morlot, 2010; Hunt and Watkiss, 2011). This is particularly true for urban settlements in South Africa, which account for the majority of the country's population and economic output, and within which a complex combination of interconnected climate impacts plays out relating to water, health, energy, transport and mobility, land use, buildings and insurance (Parnell et al., 2007; Ziervogel et al., 2014b). If urban climate adaptation aims at sustaining the gains in wellbeing and reductions in poverty that are achieved through development efforts in the face of an altered climate, then it sits squarely within the developmental mandate of local government in South Africa (Roberts, 2010; Ziervogel and Parnell, 2012). As such, local governments have a key role to play in planning and facilitating climate change adaptation in South Africa's urban areas. However, because many of the drivers and impacts extend beyond municipal boundaries, support and coordination needs to be provided by higher spheres of government to create an integrated and coordinated approach (Taylor et al., 2014; du Plessis and Kotzé, 2014).

This chapter briefly characterises South African cities and outlines the types of climate change impacts experienced and expected in South African cities, before reviewing the range of legislative and policy tools that are currently available to local governments to undertake climate adaptation. The review

shows that the existing legal and policy framework offers a variety of potential entry points for local government to respond to climate change risks and impacts. However, sector specific laws and policies fail to address the complexity and interconnectedness of risks, impacts and adaptation measures as they manifest in urban settings and do not provide the wherewithal to tackle many of the practical challenges faced by local governments attempting to undertake climate adaptation. Many of the challenges are predominantly political, economic and organisational in nature, as discussed in the fifth section of the chapter. Section 5 lays out a number of challenges pertaining to the structure and functioning of local government, the form and dynamics of South Africa's urban areas, and the nature and framing of the climate change problem that currently makes the planning and implementation of climate change adaptation difficult in practice. This section draws extensively on the collective experience of colleagues in the CCT's Environmental Resource Management Department, notably Gregg Oelofse, Helen Davies and Saul Roux, as well as Darryl Colenbrander, who co-produced much of the knowledge contained in this chapter as part of the MUF Knowledge Partnership. Methodologically, the co-production of this chapter, much of which was published as a chapter in a book entitled 'Climate Change: Law and Governance in South Africa' (Humby et al., 2016), formed an important contribution to strengthening relationships and integrating academic and practitioner knowledge that lies at the heart of undertaking embedded research.

The chapter suggests that it is not primarily a lack of legal and policy provisions that stands in the way of climate adaptation in South African cities, but rather a lack of integration of these pieces of legislation and a far more complex set of governance issues, social, economic and political in nature, that constrain the application and effectiveness of these tools for addressing climate change. The identification of these challenges, primarily from a local government practitioner perspective, further supports the rationale for the research design of this doctoral study.

5.2. South Africa's urban landscape

South Africa is well into an urban transition. Approximately 63% of South Africa's population now lives in urban areas, including cities and towns, which is projected to increase to 71% by 2030 and 80% by 2050 (Department of Co-operative Governance and Traditional Affairs (COGTA), 2013). Urban areas play a critical role in the country's economy, producing approximately 80% of the national gross value added (GVA), a measure of net economic output (COGTA, 2013). The nine largest cities in South Africa (i.e. Buffalo City, Cape Town, Ekurhuleni, Durban, Johannesburg, Mangaung, Nelson Mandela Bay, Msunduzi and Tshwane) account for 40% of the national population and 60% of national economic output (South African Cities Network (SACN), 2011). Consequently, how climate change is tackled in cities and towns will have significant bearing on how the country fares as a whole, in terms of limiting negative climate change impacts, harnessing new opportunities through climate change adaptation and constraining carbon emissions through climate change mitigation. However, it is important to point out that urban areas do not operate in isolation. They are interconnected with, and reciprocally reliant on, the rural parts of the country, both in terms of the movement of people and the supply of resources such as food, water, electricity, timber and metals. Rural areas in turn rely on urban areas for technical inputs, financial flows, markets and tertiary services.

Despite being economic hubs, levels of unemployment in South Africa's cities and towns remain unacceptably high, especially amongst the youth. Data from 2012 show that on average 24% of the working age population (defined as those between the ages of 15 and 64) living in the country's major cities are able, willing and actively looking for work but are unemployed, while this unemployment figure is slightly higher at 26% in South Africa's secondary cities (Turok and Borel-Saladin, 2013). South Africa's cities are characterised by low average population densities (relative to international standards) and

sprawling spatial form (Turok, 2011). They still display the spatial, social and economic patterns of racial and class-based segregation and inequality that were established under the Apartheid regime (COGTA, 2013). Despite considerable investment in extending and upgrading infrastructure networks and providing subsidised housing, with high levels of urban growth and limited public budgets, levels of service provision within urban areas remain highly variable. Many low-income areas remain under-serviced in terms of electricity, water, waste management, stormwater management, public transport, health, education and community services (e.g. libraries and parks). On average around 20% of urban households in South Africa live in informal dwellings and in some towns and cities this figure continues to rise (SACN, 2011). Addressing imbalances in levels of service provision and reducing the proportion of households living in informal dwellings, within the constraints of municipal budgets, is a key priority and concern in all urban areas across South Africa. Climate change adds a further stress to these systemic challenges facing South Africa's urban areas and therefore requires an integrated and multi-sectoral approach in an urban context. Climate change is also set to have a proportionally worse impact on poorer communities, making them even more vulnerable in times of stress (Dodman and Satterthwaite, 2008).

5.3. Climate impacts in South African cities

The impacts of climate change in South Africa's urban areas are already being felt (Ziervogel et al., 2014b). Many of the larger South African cities have undertaken initial climate change assessments to gather available information on the types of climate-related risks, vulnerabilities and impacts they face, both currently and projected for the future (CCT, 2006; Phalatse and Mbara, 2009; Golder Associates Africa, 2010; Brundrit and Cartwright, 2012; Tadross and Johnston, 2012). These assessments aim to connect local specificities with the trends and projections being reported through national and global assessments, such as the South Africa's Long Term Adaptation Scenarios (Department of Environmental

Affairs (DEA), 2013) and the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2014). The assessments suggest that global changes in the climate system may translate, for various parts of South Africa, into a combination of hotter temperatures, changes in the quantity of rainfall (decreases in the annual average over the west and south of the country and increases over the eastern region), increasing intensities of rainfall events, more frequent droughts, rising sea levels and larger storm surges (although the levels of confidence in each of these trends and the level of agreement between model-generated scenarios is variable) (DEA, 2013; Ziervogel et al., 2014b; IPCC, 2014). In South Africa's urban settlements these climate conditions, interacting with existing developmental challenges, are associated with a range of impacts (SACN, 2014; IPCC, 2014; Taylor et al., 2014), including:

1. Service infrastructure damage, interruption and collapse (water, waste, transport, sanitation, electricity);
2. Decreasing ecosystem functioning with knock-on impacts on water quality, flood attenuation, air quality, soil erosion, biodiversity, fish and other marine species, and the salinity of groundwater and soils;
3. Water, energy and food insecurity and increasing costs of provision of basic services due to complex interactions between climate, population and economic changes, often affecting the poor worst because of already stretched household budgets and thereby further entrenching inequality and also potentially undermining business viability in water- and energy-intensive industries;
4. Increasing health burden, particularly in the more vulnerable communities, and greater demands on already stretched public health services;
5. Increasing need for and cost of disaster response and management of extreme weather events (floods, fires and coastal inundation), including relief for displaced people;

6. Losses in key sectors of the city-region economy such as tourism, property values, industry, manufacturing and agriculture, potentially leading to increased levels of unemployment, with potential knock on effects for crime and violence;
7. Increasing municipal, corporate and household expenditure on protecting and insuring infrastructure, property and assets against storm, water and fire damage;
8. Introduction of carbon taxes (international and domestic) placing significant additional burden on the urban economy;
9. Potential liability of local governments for not addressing climate change related risks in development approvals and planning.

Considering the nature of these climate impacts, urban adaptation in South Africa entails adjustments in the spatial and economic configuration of towns and cities, the positioning, design and maintenance of infrastructure (including water, drainage, transport, electricity, health-care and housing infrastructure), the financing arrangements of public services, and the management of ecosystems (including freshwater, coastal, forest and grassland ecosystems) that underpin economic activity and human well-being. Local governments are thereby at the forefront of responding to a wide range of risks and impacts posed by changes in the global climate system that manifest locally and interact with other pressing urban challenges. However, local governments cannot single-handedly make the kind of adjustments required and therefore collaboration and coordination with urban actors in the business and civil society sectors and other spheres of government is critical. When considering the legislative and policy framework for urban adaptation it is therefore necessary to include laws and policies pertaining to both the built environment and the natural environment and the derived services provided within urban areas (i.e. services underpinned by infrastructure networks and/or ecosystems). The following section reviews South Africa's climate change policy and the laws pertaining to local government and to sectors

directly impacted by the climate. One notable omission is that of health. Climate change is expected to alter patterns of health risks and impacts and should therefore be reflected in health law and policy. But because health is largely a competency of the provincial and national spheres of government it is not discussed in this chapter.

5.4. Review of South African legal and policy framework through a climate adaptation lens

As highlighted in section 5.3, climate change impacts on a range of local government functions and services. Climate change adaptation within a city therefore cuts across and creates linkages between the policies and practices of a number of sectors. Understanding the potential for municipalities, particularly metropolitan municipalities, to undertake climate change adaptation, climate risk management and/or climate-resilient development requires a review of not only environmental law and local government law, but also laws dealing with spatial planning, land-use management, building regulations, water, coastal management, and disaster-risk management. This section of the chapter reviews a suite of South African policies and laws that potentially provide the impetus and tools or mechanisms for local governments to undertake climate change adaptation. In so doing it highlights the cross-cutting nature of addressing climate change risks and impacts, suggesting multiple entry points for municipalities to adapt proactively, while also revealing the fragmented nature of the legislative framework in which they have to operate.

5.4.1. National Climate Change Response Policy: Role of local government in adapting to climate change

The National Climate Change Response Policy (NCCRP), published in 2011, establishes climate change adaptation as a national priority by recognising the inevitability of climate change impacts and therefore the need to manage these impacts through interventions that build resilience and emergency response capacity (RSA, 2011). All three spheres of government are noted as having key roles to play in adaptation, involving both sectoral interventions and measures that require co-ordination between sectors and departments. The ministerial political (MINMEC) and technical (MINTECH) forums, set up through the Intergovernmental Relations Framework Act 13 of 2005 (RSA, 2005a), are tasked with guiding and facilitating policy and strategy coherence between climate change actions across the three spheres of government. The MINMEC and MINTECH structures, chaired by the Minister and the Director General of Environmental Affairs respectively, have been extended to include nine provincial departments responsible for environmental affairs, in addition to National Treasury, many national sector departments, public entities and other partners, notably including the South African Local Government Association. A national government report (DEA, 2011), however, highlights the high-level and sector-orientated nature of the MINMEC and MINTECH structures as a major weakness that undermines their capacity to facilitate the mainstreaming of climate change measures. This has been partially overcome through the Intergovernmental Committee on Climate Change that provides a platform for active engagement across most national departments, provincial governments and, to a limited extent, local governments.

The NCCRP (RSA, 2011) directs all government departments to review policies, strategies, legislation, regulations and plans in their jurisdiction to fully align them with the NCCRP within two years of publication (i.e. October 2013). While this process is underway at the national level, there is as yet little

indication of and no funding support for a similar review and alignment within provincial and local government.

Within the NCCRP, local government is explicitly acknowledged as playing 'a crucial role in building climate resilience through planning human settlements and urban development; the provision of municipal infrastructure and services; water and energy demand management; and local disaster response, amongst others' (RSA, 2011, section 10.2.6). The NCCRP, however, acknowledges that 'the mandate for local government to take on various specific climate change-related issues is not always clear, and it may be useful to assign specific powers for mitigation and adaptation actions such as coastal management, infrastructure management and natural resource stewardship, some of which fall within the jurisdictions of other spheres of government' (RSA, 2011, section 10.2.6). The NCCRP suggests a critical review of policy and legislation relating to local government functions and powers with respect to climate change, to be led by the Department of Co-operative Governance and Traditional Affairs. The NCCRP further acknowledges that fiscal mechanisms to support local government capital and operating expenditures do not currently incentivise municipalities to mainstream climate change responses, which is therefore to be reviewed by National Treasury. The policy commits to the establishment of an interim climate finance co-ordination mechanism to secure the necessary resources for adaptation and mitigation priority programmes.

Urban and coastal settlements are noted as being particularly at risk of climate change impacts and therefore municipalities are directed to develop effective information, monitoring and assessment tools to evaluate the resilience of towns and cities, to integrate downscaled climate projections into medium- and long-term spatial development plans and information systems, and to identify adaptation priorities. Municipalities are further instructed to promote urban densification; incorporate thermal

efficiency and climate-resilient technologies into the design of low-cost houses; apply water-sensitive urban design principles to urban infrastructure planning; ensure that land-use zoning regulations are enforced; and consider climate impacts and the need to sustain ecosystem services when assessing development proposals.

Coastal municipalities are directed by the NCCRP to ensure that municipal coastal management plans incorporate climate information; factor sea-level rise and storm surges into the location of the high-water mark and coastal set-back lines; protect and rehabilitate natural systems that act as important coastal defences; and support ongoing research to determine climate change impacts on coastal livelihoods and identify appropriate responses (RSA, 2011).

It is of relevance to metropolitan local governments that the sectors of water, health, biodiversity and ecosystems, and disaster risk reduction and management are also prioritised for adaptation within the policy. The water interventions are to cover water planning, water conservation and demand side management, exploring alternative water sources, and assessing water adaptation options. The health interventions cover addressing food security, and public awareness campaigns regarding coping with climatic changes. In terms of natural systems, local governments are encouraged to manage natural ecosystems to improve resilience and manage the spread of alien and invasive species. Lastly, on the disaster management front, municipalities are encouraged to develop and improve early warning systems for extreme weather and climatic events and all municipalities are directed to factor climate change into Disaster Risk Management plans.

As illustrated above, the NCCRP (RSA, 2011) sets out an ambitious multi-scalar and multi-sector set of climate change responses. It tasks local governments, in co-operation with other spheres of

government, with mainstreaming responses to climate change on many fronts in terms of regulation enforcement, policy revision, planning, programming and monitoring. However, the decision-making approaches (both political and technical) and the resourcing (both human and financial) required to undertake such actions are not yet available within municipalities and have not been provided for by national government, which severely constrains implementation.

5.4.2. The Constitution: Municipal mandates for climate change adaptation

Within post-Apartheid South Africa, local government has been Constitutionally assigned a developmental mandate, which obligates municipalities to 'ensure the provision of services to communities in a sustainable manner' and 'promote a safe and healthy environment' (RSA, 1996, Section 152(1)b and Section 152(1)d). With this developmental mandate comes far greater autonomy and responsibility than the pre-1990s era. In terms of the Constitution, a local government has 'the right to govern, on its own initiative, the local government affairs of its community, subject to national and provincial legislation' (RSA, 1996, Section 151(3)). This includes taking legislative and executive responsibility to respect, protect, promote and fulfil the environmental right, the right to equality, the right to life, the right to human dignity and the right of access to sufficient water, each of which is linked to the impacts of climate change (Du Plessis and Kotze, 2014). The key mandates linked to local governments are listed in Schedule 4B and 5B of the Constitution (RSA, 1996). Competencies listed in Schedule 4B potentially relevant for adaptation include building regulations, firefighting services, municipal planning, municipal health services, municipal public transport, municipal public works, storm-water management systems and water and sanitation services. Relevant competencies listed in Schedule 5B include beaches, municipal parks and control of public nuisances.

A range of legal opinions have outlined local government's mandate in terms of climate change adaptation activities. In this respect, De Visser (2012) argues that many of the aspirations of municipalities with respect to climate change adaptation are hindered by conservative interpretations of their mandate. Du Plessis and Kotze (2014, pp.156-157) go further by closely interrogating the provisions of the Constitution to argue that '[e]very municipality must structure and manage its operations (including budgeting, planning and land-use management) to avoid, minimise and address negative climate impacts which may affect the fulfilment of its basic Constitutional duties' and that 'the Constitution grants almost limitless scope for specifically local government's intervention in responding to climate change'. The Constitution (RSA, 1996), when interpreted with climate change in mind, thereby establishes a firm legal foundation on which municipalities can and should build and implement a comprehensive set of climate change adaptation measures in order to ensure the safety and sustainability of the communities and local environment within its boundaries.

5.4.3. Local Government: Municipal Systems Act: Municipal legislative authority, integrated development planning, and performance management

The Constitutional duties of local government to 'ensure the provision of services to communities in a sustainable manner' and 'promote a safe and healthy environment' are repeated in the Local Government: Municipal Systems Act 32 of 2000 (RSA, 2000a, Section 4(2)(d)(i)). In terms of the Municipal Systems Act (RSA, 2000a), as read with the Constitutional scheme discussed above, a municipality may exercise executive and legislative authority within its boundaries. Of relevance to climate change adaptation is that a municipality may exercise this authority by implementing applicable national and provincial legislation and passing by-laws. Accordingly, a municipality may enact by-laws to regulate matters for which it has Constitutionally-derived powers. In respect of climate change, municipalities may potentially enact by-laws on matters such as stormwater management, coastal management, water

demand management, environmental health and disaster risk management. This can be done as long as such by-laws do not conflict with national or provincial legislation.

As Du Plessis (2012, p.368) comments: '[t]hese mandates are broad and open to interpretation, which serves to show that now, more than ever in the history of South Africa, local government has significant scope to experiment and innovate.' Despite this supposed scope to experiment and innovate, however, recent research has found that senior municipal management, particularly municipal Chief Financial Officers (CFOs), have argued for a more defensive interpretation of the legislation and a more risk-averse approach to financial management, driven largely by a fear of Auditor-General findings relating to wasteful expenditure, a short-term focus on institutional financial sustainability and concerns with the criminalisation of mismanagement (National Treasury Technical Assistance Unit (TAU) and Western Cape Government (WCG), 2013). This leads to an avoidance of untested approaches and technologies, thereby undermining many practical efforts at experimenting and innovating on financial grounds.

A critical tool for municipal climate change adaptation entrenched by the Municipal Systems Act (RSA, 2000a) is integrated development planning, which is defined as developmentally orientated planning that, *inter alia*, lays out a vision for the long-term development of the municipality, the council's development priorities and objectives for its elected term, a spatial development framework, applicable disaster management plans and a financial plan, all of which have to align and give effect to the objects of local government, duties and rights set forth in the Constitution (RSA, 1996). Of particular relevance to adaptation is that the Municipal Systems Act (RSA, 2000a, Section 23(1)(c)) requires that municipal planning must 'contribute to the progressive realisation of the fundamental rights contained in sections 24 . . . of the Constitution', which includes the right to an environment that is not harmful to people's health or well-being.

There is a strong argument that the effects of climate change may severely impact on the long-term development trajectory of cities and, accordingly, climate adaptation measures need to be integrated and co-ordinated in a municipality's integrated development plan (IDP). Furthermore, the Municipal Systems Act expressly stipulates that disaster management plans must form a core component of IDPs. This illustrates that municipal IDPs are explicitly required to address and reduce risks to long-term development, including risks associated with climate change, which are already understood to be affecting the disaster risk profile of cities in South Africa (Pharoah et al., 2013; Piketh et al., 2014).

It is also possible to include climate adaptation targets, indicators and objectives within municipal performance management systems (PMS). There are no prohibitions in doing so, as long as it accords with the Municipal Systems Act. The Municipal Systems Act (RSA, 2000a, Section 38(a)(ii) and (iii)) directs municipalities to establish a PMS that is 'best suited to its circumstances' and one that 'is in line with the priorities, objectives, indicators and targets contained in its integrated development plan'. Accordingly, if adaptation objectives are incorporated in a municipal IDP, the associated targets and indicators may form part of the municipal PMS. This assignment of accountability for adaptation objectives should promote cross-departmental implementation and also potentially facilitate political and administrative buy-in through explicitly and practically connecting ambitions of reducing climate change risks and impacts with the operations of primary public service functions (such as water, energy, housing, solid waste and transport) that tend to be the focus of budget allocations and political pressure. However, while this should contribute to shifting climate change from a non-urgent environmental issue to an urgent socio-economic one that cuts across all line functions, this is not yet the case. With most municipalities not placing significant priority on climate change-related outputs and outcomes, projects that contribute to achieving the PMS outputs and outcomes are prioritised over climate-change-related projects that are

more difficult to implement, are often caught up in lengthy approval processes, have longer time horizons and are more difficult to cost. The process of getting environmental indicators onto the PMS is incredibly difficult, as the IDP and consultation processes prioritise rapid delivery of basic services and addressing backlogs–often in an unsustainable manner (Sowman and Brown, 2007).

In sum, if climate responses are to gain traction in municipalities, it is paramount that adaptation measures are properly represented in municipal IDPs and by extension in the PMSs. This is important because an IDP 'is the principal strategic planning instrument which guides and informs all planning and development, and all decisions with regard to planning, management and development, in the municipality' (RSA, 2000a, Section 3(d)).

5.4.4. Spatial Planning and Land Use Management Act: Spatial targeting of climate change adaptation

Spatial planning and land-use management provide critical tools for urban climate adaptation responses. These tools can be used, for example, to establish coastal and catchment setbacks (a line demarcating an area within which development will be prohibited or controlled in order to achieve the objects of the Integrated Coastal Management Act (RSA, 2008) and/or local coastal management objectives) and an urban edge (a line demarcating the area within which urban development will be contained through the promotion of densification to limit urban sprawl). Urban climate adaptation measures can be inserted in spatial development frameworks (SDFs), zoning schemes and/or urban policies developed in terms of planning laws, such as densification policies.

The recently promulgated Spatial Planning and Land Use Management Act (SPLUMA) provides, broadly, for the inclusion of adaptation measures in municipal land-use systems (RSA, 2013). A key object

of SPLUMA is to 'provide for the sustainable and efficient use of land' (RSA, 2013, Section 3(d)). SPLUMA sets out a number of development principles that bind local government in regulating the use and development of land. Local government is legally required to adhere to these development principles when 'preparing and implementing a spatial development framework, land-use scheme, policy or by-law concerning spatial planning' (RSA, 2013, Section 6).

SPLUMA includes a number of development principles that are relevant to climate change adaptation (RSA, 2013). These include principles of spatial justice, spatial sustainability and spatial resilience. The principle of spatial justice aims to redress past spatial imbalances and requires the inclusion of informal settlements in SDFs. This means that informal settlements need to be explicitly considered in any local authority's long-term growth planning. Informal settlements are in many cases the most vulnerable to climate change impacts because of their location on hazardous land, low levels of public service provision, high levels of unemployment and insecure livelihoods, and municipalities will therefore need to address climate change explicitly in their SDFs. In light of climate change, the principle of spatial sustainability requires that spatial planning and land-use management protect agricultural land that is critical to food security and local employment; consider all current and future costs in the provision of infrastructure and social services (for example water provision under lower annual rainfall and higher temperatures); promote land development in locations that are not at risk to damage from climate events such as flooding from heavy rains and sea storm surges; and limit urban sprawl that increases the unit cost of public service provision, destroys ecosystems that provide natural buffer capacity from extreme weather and climate events, and undermines agricultural productivity. The principle of efficiency included in SPLUMA (RSA, 2013) requires that municipalities minimise negative financial, social, economic or environmental impacts in their decision-making procedures. This again points to the need to consider the short, medium and long-term impacts of climate change and the integration of adaptation measures into

development planning decisions. Should municipalities develop in areas of climate risk, the long-term costs to the municipality and to communities will be high. This can be seen in Cape Town where, every year, communities in flood-prone areas (many of which are informal settlements) are flooded out of their homes, with the municipality having to provide community shelters and food parcels and with communities losing possessions, a sense of safety and sometimes their livelihoods. Finally, SPLUMA requires adherence to the principle of spatial resilience 'whereby flexibility in spatial plans and land-use management' should ensure 'sustainable livelihoods in communities most likely to suffer the impacts of economic and environmental shocks' (RSA, 2013, Section 7(d)). This can be regarded as an explicit directive for municipalities to consider impacts of climate change in spatial and land-use planning.

Guided by these principles, SPLUMA requires municipalities to prepare an SDF based on a long-term spatial development vision indicating a desired spatial growth and development pattern for the next ten to twenty years (RSA, 2013, Section 21(1)(c)). The SDF must identify long-term risks of particular spatial patterns and identify policies and strategies necessary to mitigate those risks, promoting a rational and predictable land development environment. The SDF must also include a strategic assessment of the environmental pressures and opportunities within the municipal area, including the spatial location of environmental sensitivities, high potential agricultural land and coastal access strips (RSA, 2013).

Climate change risks and impacts will have to be considered in the long-term spatial development vision of a municipality, given the extent to which they could influence long-term growth and development patterns. For example, increases in rainfall could lead to changes in flood lines; a failed agricultural sector could lead to an influx of people to cities and to depressed economic growth where the local economy is reliant on agro-processing and food exports; water shortages could limit economic and

residential growth; and coastal storm surges could render areas of the coast too dangerous to develop or make it too costly to maintain and insure existing developments.

Furthermore, in terms of SPLUMA, each municipality must 'adopt and approve a single land-use scheme for its entire area' (RSA, 2013, Section 24(1)). Of relevance to climate adaptation, these municipal land-use schemes must take cognisance of any environmental management instrument adopted by the municipality and comply with environmental legislation, and may include specific requirements regarding any special zones identified to address the development priorities of the municipality. SPLUMA stipulates that all land-use decisions municipalities make must comply with measures designed to protect and promote the sustainable use of land (RSA, 2013). This facilitates consideration of potential future impacts of climate change on the land and the potential risk to people and infrastructure created by approving development on parcels of land that are projected to be at high risk under future climate conditions. By establishing development principles of spatial justice, sustainability, efficiency and resilience that guide municipalities in preparing an SDF and a single-land-use scheme, SPLUMA (RSA, 2013) provides a critical set of tools for undertaking local climate adaptation.

The authority of municipalities to use spatial planning and land-use management tools to protect natural landscapes and green open spaces from property development and to manage these natural areas and ecosystems for biodiversity, climate adaptation and ecosystem service provision has been tested in the case of Le Sueur versus eThekwini Municipality in 2013[3]. The case challenged the Constitutional right of municipalities to take land-use decisions based on an environmental mandate when, as argued by the applicant, 'environment' is listed in Schedule 4A of the Constitution (RSA, 1996) as a functional area of concurrent national and provincial legislative competence. The case was brought against eThekwini

[3] Le Sueur and Another v Ethekwini Municipality and Others (9714/11) [2013] ZAKZPHC 6 (30 January 2013).

Municipality in reaction to the integration of the Durban Metropolitan Open Space System (D-MOSS) into the Town Planning Scheme. D-MOSS identifies areas of ecological sensitivity and environmental importance within the city and aims to protect them from development by applying stricter rules on the development activities that can be undertaken, thereby requiring owners of such land to apply for permission when undertaking any property development. Le Sueur, an affected property owner and developer, sought for the amendments to the town planning scheme to be set aside as unconstitutional. However, the decision by the KwaZulu-Natal High Court in Pietermaritzburg went in favour of the municipality, finding that the Constitution does provide municipalities with the authority to regulate the local environment through municipal planning as a means of realising the environmental right enshrined in the Constitution (RSA, 1996) through the principles of co-operative governance.

5.4.5. National Environmental Management Act: Environmental principles and model by-laws

The National Environmental Management Act 107 of 1998 (NEMA) requires municipalities to adhere to a range of environmental principles in the preparation of any policy, programme or plan, including IDPs (RSA, 1998a). Principles relevant to climate adaptation include the need for development to be socially, environmentally and economically sustainable. Further to this, sustainable development is regarded as development that avoids the disturbance of ecosystems and loss of biological diversity, avoids degradation of the environment, applies a risk-averse and cautious approach which takes into account the limits of current knowledge about the consequences of decisions and actions, and anticipates and prevents negative impacts on the environment and on people's environmental rights (RSA, 1998a, Section 2).

If climate adaptation is understood as an integral part of both sustainable development and environmental management, then NEMA (RSA, 1998a) includes a number of principles that have

implications for how South Africa's municipal governments undertake climate adaptation. NEMA requires that environmental management must be integrated and take into account the effects of decisions on all aspects of the environment and all people by pursuing the selection of the best practicable environmental options (RSA, 1998a). NEMA also requires that a risk-averse and cautious approach be applied, which takes into account the limits of current knowledge about the consequences of decisions and actions (RSA, 1998a). This is particularly pertinent to the uncertainties regarding the timing and scale of specific future local climate changes and their impacts, but could cause a conundrum for municipalities that are financially stretched and so cannot afford to plan for the worst-case scenarios of climate change. The principle regarding the need for environmental justice to ensure that adverse environmental impacts are not distributed in such a manner as to discriminate unfairly against any person is crucial to climate change adaptation, as poorer communities are often most vulnerable to climate change because they have fewer reserves, are often uninsured, have insecure employment and livelihood activities, and are more directly reliant on natural resources and ecosystem services such as groundwater, wild food sources and fuelwood. People are required to take responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity as it exists throughout its life cycle, which would mean factoring in the short-and long-term impacts of climate change. Sensitive, vulnerable, highly dynamic or stressed ecosystems (such as coastal shores, estuaries and wetlands) will be most at risk from the impacts of climate change and require specific attention in management and planning procedures, especially where they are subject to significant development pressure.

In terms of NEMA (RSA, 1998a) the Minister may make model by-laws for the management of environmental impacts of any development within the jurisdiction of a municipality, such as has been passed for air quality. The purpose of such a by-law is to mitigate adverse environmental impacts, facilitate

the setting of norms and standards in respect of existing activities and developments, and ensure effective environmental management and conservation of resources within the jurisdiction of a municipality.

Given the need to consider the long-term impact of decisions, to take account of the uncertainty with regard to climate change and to balance environmental and socio-economic needs to ensure that adaptation to the impacts of climate change is possible, the principles, tools and directives related to local government outlined in NEMA (RSA, 1998a) could easily apply to a range of urban climate adaptation objectives. These may include ensuring the supply of natural resources, such as water, reducing the impacts of flooding, reducing the threat of food insecurity, rehabilitating and maintaining natural systems so that they are able to provide ecosystem services, and ensuring that homes which are built are thermally efficient and fire and flood-proof. Accordingly, NEMA (RSA, 1998a) contains a number of principles and provisions which can strengthen and support adaptation measures adopted, or which should be adopted, by local government.

5.4.6. National Environmental Management: Integrated Coastal Management Act

Many of South Africa's coastal areas are highly vulnerable to and may be extensively affected by climate change, unless adaptation measures are undertaken to address this (Colenbrander and Sowman, 2015). Two of South Africa's largest cities, Cape Town and Durban are located on the coast. The Integrated Coastal Management Act (ICMA) (RSA, 2008) provides for the integrated management of the coastal zone by all three spheres of government and includes a number of mechanisms that, if used in the right way, could support the collective management of the coast in order to reduce the impacts of climate change. These mechanisms include the delineation of coastal public property, coastal protection zones and coastal set-back lines and the establishment of special management areas and municipal coastal management programmes (RSA, 2008). While these are all separate mechanisms with different intentions, they need

to be developed and applied in a way that promotes their integration in order to take a coherent and systemic approach in light of complex coastal dynamics.

ICMA provides for the declaration of coastal public property (i.e. land submerged by coastal waters, any island within coastal waters and the seashore) to be held in trust by the State on behalf of citizens (RSA, 2008). The Minister may declare any state-owned land as coastal public property in order to manage potential or actual climate change impacts on the coast. In doing so the declaration may serve to protect sensitive coastal ecosystems, secure the natural functioning of dynamic coastal processes and protect people, property and economic activities from risks arising from dynamic coastal processes affected by changing climate conditions (notably sea-level rise and increased storm surges).

Coastal planning mechanisms play a critical role in protecting people, infrastructure and ecosystems from the impacts of climate change (Colenbrander and Sowman, 2015). More specifically, the careful management of the coastal zone through the application of these planning mechanisms could enhance their ability to adapt to climate change through the protection of the ecological integrity, natural character and economic, social and aesthetic value of coastal public property; avoiding an increase in the effect or severity of natural hazards in the coastal zone; maintaining the natural functioning of the littoral active zone; maintaining the productive capacity of the coastal zone by protecting the ecological integrity of the coastal environment; and allowing for rescue operations (RSA, 2008). Special management areas may be declared if 'environmental, cultural or socio-economic conditions in that area require the introduction of measures' to effectively attain the objectives of the relevant coastal management programme, facilitate community coastal resource management, promote sustainable livelihoods and conserve, protect or enhance coastal ecosystems and biodiversity (RSA, 2008, Section 23).

According to the ICMA (RSA, 2008), coastal setback lines and regulations to manage any development within the setback lines must be established by provincial government in consultation with municipalities in order to protect coastal public property, private property, public safety and the coastal protection zone. Municipalities must the include these lines in their zoning schemes and regulate development accordingly to reduce risk, presenting an important mechanism for integrating and adapting to climate change risks if applied and implemented progressively (Colenbrander and Sowman, 2015).

Finally, in terms of ICMA all coastal municipalities must prepare and adopt municipal coastal management programmes (CMPs) for managing coastal zones (RSA, 2008, Section 48(1)). These programmes are to be mainstreamed into core municipal functions by preparing and adopting them as part of an IDP and SDF. Ensuring the inclusion of climate change considerations in these plans will thereby contribute to the integration and mainstreaming of climate adaptation objectives and measures into the IDP and SDF. However, CMPs have little legal weight and are more operational guidelines. Municipalities therefore need to develop a by-law to enforce the CMP.

5.4.7. National Environmental Management: Protected Areas Act

In the context of climate change, protected areas can both protect biodiversity from the impacts of climate change and ensure sustained ecosystem goods and services within the context of a changing climate. The National Environmental Management: Protected Areas Act (RSA, 2003a) allows for the Minister to acquire land and declare it a protected area through purchase, exchange or expropriation, and can, therefore, be used as a climate change adaptation tool, including in urban areas. While the Act (RSA, 2003a) does not authorise local government to declare a protected area, an area under municipal jurisdiction may be declared a special nature reserve, national park, national reserve or protected environment and municipalities may be delegated the power to be a management authority of such

protected areas (Middleton et al., 2011). If used strategically, this could enable municipalities to protect the ecological functioning and biodiversity value of their natural areas from the impacts of climate change. It may also enable the preservation of natural open spaces (such as estuaries and local forest patches within urban boundaries) that provide critical buffering capacity in times of climate extremes like heat spells and heavy rains.

5.4.8. National Environmental Management: Biodiversity Act

Ecosystem goods and services can be used to buffer the impacts of climate change on human settlements and economic activities and this is referred to as ecosystem-based adaptation (Muang et al., 2013). Ecosystem-based adaptation is a key component of the National Biodiversity Framework and the National Environmental Management: Biodiversity Act (NEMBA) (RSA, 2004), which states that municipal IDPs must align with and outline means to implement the National Biodiversity Framework. This should therefore drive municipalities to incorporate ecosystem-based adaptation principles into IDPs. In addition, this Act (RSA, 2004) sets out a number of obligations on local government that would strengthen the protection of biodiversity and ecosystems and thus their ability to adapt to climate change and deliver services that protect human settlements and economic activities (services such as flood attenuation, water filtering, providing nutrition and fuel and soil stabilisation). These obligations include the duty to align by-laws, biodiversity management plans and conservation plans with NEMBA (RSA, 2004) and to consider threatened ecosystems and invasive species management in IDPs. This has particular relevance to climate change, as threatened ecosystems may be the most vulnerable to climate change and invasive species will tend to thrive and spread in a warmer climate, further negatively affecting biodiversity, absorbing further water resources and increasing fire risks. Many of the responsibilities and functions of local government provided for in NEMBA (RSA, 2004) and the Protected Areas Act (RSA, 2003a) can be used as tools for urban ecosystem-based adaptation.

5.4.9. National Water Act and Water Services Act

Projected climatic changes for South Africa include changing rainfall patterns, affecting water supplies with consequent impacts on matters such as water quality, water pricing, ecosystem services, agricultural productivity, health, access to water and economic productivity (DEA, 2013). Given that many areas within South Africa are already water-stressed and are becoming more so with urbanisation, population growth and economic growth, the added stress of climate change makes adaptation a priority (Schulze, 2011). Whether the average annual rainfall is set to decrease or increase, rainfall is expected to occur in more intense events, which is likely to increase the risk of flooding and resultant impacts on infrastructure, water quality, health (both morbidity and mortality), ecosystems, social welfare and economic productivity.

Three key pieces of legislation provide the framework for sustainably managing the country's water resources in the face of climate change. These are the Constitution (RSA, 1996), the Water Services Act (WSA) (RSA, 1997) and the National Water Act (NWA) (RSA, 1998b). The Constitution (RSA, 1996, Section 27) provides for the right to sufficient access to water. This right may conflict or come into tension with the statutory provisions to protect water resources for current and future generations, both of which may be at risk due to a decrease in water availability as a result of climate change (Kotze, 2010). The WSA (RSA, 1997) requires that municipalities, acting as water services authorities, produce a water services development plan which forms part of the municipal IDP. This plan must contain details of existing and proposed water conservation, recycling and environmental protection measures.

There are a number of key objects of the WSA (RSA, 1997) that have implications for municipalities acting as water services intermediaries in the face of climate change. First is the right of access to a basic water supply and the right to basic sanitation necessary to secure sufficient water and an environment

not harmful to human health or well-being. With a decrease in water supply as a result of climate change, municipalities may be challenged to meet all basic water and sanitation needs. In the case of a water services institution being unable to meet the requirements of all its existing consumers, it must give preference to the provision of basic water supply and basic sanitation. In the light of water supply challenges, municipalities may therefore have to curtail industrial and commercial water supply, which would impact negatively on the local economy and possibly on job stability. Secondly, the WSA (RSA, 1997) provides for the setting of tariffs in respect of water services. With municipalities allowed to implement by-laws for the determination and structure of tariffs, they may influence a reduction in water consumption, thus reducing the pressure on their water supplies that may be compounded by climate change. Cognisance would need to be taken, however, of the potential negative impact of increased tariffs on economic growth and on poverty alleviation efforts. Thirdly, the WSA (RSA, 1997) also provides for the preparation and adoption of water services development plans by water services authorities. This should ensure that municipalities are aware of their current water supplies and potential future impacts on their water supplies caused by climate change. The development plans should also encourage municipalities to explore diversifying their water supplies in areas of water scarcity so as to reduce vulnerability to climate change. A challenge is that without accurate downscaled rainfall data (that takes climate change into account), municipalities have to plan for their provision of water services within a vast band of uncertainty, which could result either in insufficient water provision, or in over-investment, which would have a knock-on impact on other areas of municipal service delivery. Lastly, the WSA (RSA, 1997) provides for the promotion of effective water-resource management and conservation, enabling municipalities to influence the sustainable use of water in their jurisdictional areas. But without the required resources, this may be hard to improve effectively, as discussed further in the forthcoming section on challenges facing local governments to implement these legislative frameworks.

The NWA (RSA, 1998b) sets out a number of principles that guide the manner in which national water resources are to be protected, used, developed, conserved, managed and controlled. A number of the principles guiding water-resource management are of direct relevance to climate adaptation, namely those relating to meeting the basic human needs of present and future generations, promoting the efficient, sustainable and beneficial use of water in the public interest, protecting aquatic and associated ecosystems and their biological diversity and managing floods and droughts (RSA, 1998b, Section 2). Although municipalities are not water management institutions in and of themselves, the Act (RSA, 1998b) requires the progressive establishment of catchment management agencies as subnational entities to which water resources management responsibilities are delegated. Catchment management agencies aim to delegate water resource management to the regional or catchment level and to involve local communities, within the framework of the national water resource strategy. Given that the climate change projections differ for different catchments within the country, this approach enables locally appropriate responses to climate change. Municipalities may be represented on the governing board of such catchment management agencies and would thus be encouraged to align their water-service management plans with those of the catchment management agencies.

The NWA (RSA, 1998b) also requires water-management institutions to inform the public about floods, droughts, risks posed to water quality and the failure of any dam or other waterworks (both those which have occurred and those which are likely to occur). In the face of projected climate change impacts, this requirement could become more onerous on municipalities. Furthermore, township layout plans must show lines indicating the maximum level likely to be reached by floodwaters on average once in every hundred years. This is to ensure that all persons who might be affected by potential flood hazards have access to accurate information on water-related localised climate impacts. Climate change is likely to alter the position of such flood levels, resulting in more people being affected.

5.4.10. Disaster Management Act

The Disaster Management Act (RSA, 2002) requires municipalities to establish disaster management centres and implement a framework for disaster management that ensures an integrated approach by government entities, non-governmental organisations and the private sector. This integration is to be facilitated through the establishment of a municipal disaster management advisory forum (a body in which a municipality and relevant disaster management role-players in the municipality consult one another and co-ordinate their actions on matters relating to disaster management in the municipality) and the development of a disaster risk management plan, which forms an integral part of a municipality's IDP. The plan must 'anticipate the types of disaster that are likely to occur in the municipal area and their possible effects' (RSA, 2002, Section 53(2)(b)). This directive to anticipate and prepare for future disaster risks has been strengthened with explicit references to climate change in the Disaster Management Amendment Act (RSA, 2015). The amendments made by this Act include provisions 'to reduce the risk of disaster through adaptation to climate change and developing of early warning mechanisms', and defining adaptation, in relation to human systems, as 'the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities' and, in relation to natural systems, as 'the process of adjustment to actual climate and its effects' (RSA, 2015, Section 1). The Act now stipulates that all spheres of government, including all municipalities, must include expected climate change risks and impacts in the preparation of their disaster management plans by providing measures and indicating how they will invest in climate change adaptation, including ecosystem and community-based adaptation approaches (RSA, 2015). In this way, climate change adaptation is being explicitly included in the disaster risk management legislation, not only in relation to building emergency response capacity, but also to proactively to reduce risks in order to avoid or minimise disasters.

5.5. Challenges to operationalise climate adaptation in South African cities

The review provided in the preceding section suggests there are a multitude of legal and policy tools and instruments available to local authorities to mainstream or consider elements of climate change in their policies, plans and operational practices. The fragmented nature of these tools and instruments, however, makes a coherent and comprehensive approach to climate adaptation at the municipal scale difficult to achieve. The challenges facing local governments, specifically city governments, in South Africa to implement the legal and policy tools for undertaking climate adaptation are explored in this section.

The challenge regarding all policy and legislation is in its implementation. Put differently, no matter how well intentioned and clearly articulated, policy and legislation is ultimately only as effective as the extent to which and manner in which it is applied (Paterson and Kotzé, 2009). As reviewed in the previous section, there is a plethora of progressive South African law and policy that potentially makes provision for local government to undertake climate change adaptation. While the NCCRP (RSA, 2011) provides an overarching guide for addressing climate change, its alignment with other national policies and legislation is still being assessed and the development of a Climate Change Act is still under discussion. Consequently, local governments have to piece together components of various policies and legislation to make the case for addressing climate change and to develop a practical approach for doing so. The reality is that while legislation should help to iron out governance complexities, current climate change related legislation does not. As has been experienced by officials in the municipalities who have been attempting to integrate climate change adaptation in their work, notably eThekwini (Roberts, 2012; Roberts and O'Donoghue, 2013) and Cape Town (Cartwright et al., 2012a), but also Johannesburg, Ekurhuleni and Msunduzi, there are at least nine key aspects of South African cities and local governments that contribute to the difficulties associated with furthering a climate change adaptation agenda locally. Each of the nine are briefly introduced below. It is important to reiterate that this section draws

extensively on the collective experience of colleagues in the CCT's Environmental Resource Management Department, notably Gregg Oelofse, Helen Davies and Saul Roux, as well as Darryl Colenbrander. Through numerous meetings, discussions and providing feedback on earlier drafts of the chapter, they co-produced much of the knowledge contained in this chapter.

5.5.1. Socio-economic realities and urbanisation

South Africa is a highly inequitable developing nation with significant levels of poverty and unemployment. As a result, a large proportion of South Africa's urban population live in informal settlements, without adequate shelter, with limited access to basic public services and in conditions that are not sufficient to withstand current climatic conditions. Following declining mining, fishing and agricultural sectors and poor levels of service provision in rural areas, as well as political and economic instability in many other parts of the continent, there is a steady flow of people moving into South African towns and cities in search of work opportunities and better access to services. This influx places additional pressure on urban service delivery and available resources such as land, water and electricity, and increasingly, marginal land is becoming occupied. In addition, local government officials identified the following as severe constraints on the ability to address immediate socio-economic needs in cities: revenue generation by local government is limited to payments made by those that have and can pay for services, which is then required to cross-subsidise those who cannot afford to pay; government budgets, resources and services are over-subscribed; service and housing backlogs are insurmountable; and local authorities are trapped in reactive crisis-management mode.

The deficit in public infrastructure and services creates high levels of climate vulnerability for those living without access to piped water, waste collection, drainage channels and emergency access roads, which further entrenches pre-existing inequalities. The immediacy and overwhelming scale of

these challenges puts local government in a highly reactive mode that reinforces the tendency for short-term planning. Long-term, precautionary planning and investments in experimentation and organisational learning are perceived as unaffordable luxuries, despite the fact that they may actually lead to cost savings and/or a more efficient use of resources.

5.5.2. The legacy of Apartheid planning

The spatial segregation and economic marginalisation that was legislated under Apartheid is still very evident in all of South Africa's cities and towns. This has resulted in a sprawling urban form with expanding low-density developments around the fringes of the city, which makes it more expensive for the city to provide services and public transport and places increasing pressure on land. This in turn can impact on ecosystem goods and services, all of which decrease resilience to climate change. Historical spatial segregation has also resulted in a limited availability of low-cost housing, which is often of poor quality (and therefore vulnerable to temperature increases and flooding) and positioned far from economic opportunities, increasing income spent on travel, more greenhouse gas emissions and decreasing quality of life. It has also led to a highly unequal distribution and quality of public services such as transport routes, education and health facilities, drainage networks and sanitation services, creating vastly differing levels of climate vulnerability.

Historical segregation has resulted in a significant proportion of residents living in informal settlements, often in high-risk areas, without security of land tenure, in small, crowded, 'temporary' shelters, with very limited access to public services, making them highly vulnerable to floods, fires and high temperatures and unlikely to invest in protection. Informal settlements are often on hazardous land, such as on steep slopes, in seasonal wetland areas and within riverine floodplains, making them prone to disasters. This decreases social resilience and creates a particular set of challenges for municipalities when

it comes to climate change adaptation. Much of the land that is informally occupied was vacant because it is marginal land susceptible to flooding, wind-blown sand, high temperatures and similar challenges, which means that upgrading and formalisation of such settlements is often incompatible with a risk-averse development approach and in many cases results in increased urban vulnerability. There is, however, often political pressure to develop in these marginal areas.

The sprawling and informal nature of South Africa's urban settlements has significant implications for the spatial and socio-economic distribution of climate vulnerabilities and risks, for the cost of interventions to reduce these vulnerabilities and risks, and for the effectiveness of formal institutions such as local government in regulating or intervening to reduce these. While various planning and legislative efforts are underway to reverse these trends of sprawl, such as the CCT's Urban Edge as defined in the SDF and the Densification Policy, integrated zoning schemes and building regulations, addressing these issues is complicated by housing budget allocations, high in-migration, the cost of land, the political sensitivity of relocating people and high unemployment. This reduces local government's ability to build climate resilience and assist those who are most vulnerable to it.

5.5.3. Local government political agendas

Prior to the late 1990s, when there was oversight by an elected council, municipalities were primarily administratively-led organisations that focused on the provision of basic services and the management of land use. With the shift to democracy and government restructuring in South Africa, guided by the new Constitution, this administrative environment shifted significantly as municipalities became politically contested and politically led organisations (Cameron, 2003; De Visser, 2010). Many South African cities now have executive mayors, vested with considerable authority over legislative and executive decision making within the municipality. This has lessened the role and influence of municipal

managers and senior officials concerned with the technicalities and administration of service delivery, and has resulted in a greater focus on a political mandate determined by the political party of the day (De Visser, 2010). It should be noted that this challenge of politics superseding technical planning is not unique to South African cities (Peters and Pierre, 2004). This politicisation of local government has numerous implications for adapting to climate change.

Firstly, the political focus within local government is based on a five-year election cycle, which is not conducive to the kind of long-term and precautionary planning that is required to address climate change, which occurs over multi-decade time-scales and beyond. Secondly, political mandates are primarily party-politically driven and not location-specific, with national party-political agendas driving the municipal political mandate, which means that because climate change adaptation does not feature in any substantive way in the national policy debates and positions of either the African National Congress or the Democratic Alliance it has no political currency in local politics in urban areas. Thirdly, relative to administrative procedures, political forces are playing a large part in determining the urban form, with politicians deciding to make adjustments to spatial development edges and land zoning that go against strategic plans and technical recommendations because of pressure from the business sector, affluent and influential residents and/or large, sometimes violent, social mobilisations within poor and marginalised communities (Rakodi, 2001). These strategic spatial plans are, in some municipalities, beginning to take climate change into consideration when identifying areas for growth and development versus areas to be protected and preserved in light of managing trade-offs between climate and other risks that need to be made at the city-wide scale. Changing these designations in an ad hoc manner based only on the perceived strengths and weaknesses of a specific development application compromises the ability of these plans to strengthen the resilience of cities against climate change impacts.

5.5.4. Broadening of local government functions and duties within a silo-based organisational design

The developmental mandate given to local government under the new Constitution has meant that the role of municipalities has expanded from basic service delivery (primarily water provision, electricity reticulation and refuse removal) to include new policy domains such as economic development, social development, early childhood development, sustainability, environmental management and many others. These new local government functions not only occupy a greater space on the governance agenda, but also place additional demands on municipal budgets that have not increased commensurately with these new roles and functions (Savage, 2007). As a result, climate change adaptation planning occurs within an increasingly competitive financial and policy space. There are various pieces of policy and legislation that each addresses different development concerns. A lack of overarching policy and legislation that aligns all of these distinctive objectives perpetuates fragmentation and separation of functions within municipalities, an issue which is not unique to South Africa. Working in silos and with silo-based budgets makes it difficult to recognise and address cross-cutting issues such as adapting to climate change (Kotzé, 2006).

5.5.5. Municipalities' focus on short-term, sector-specific departmental planning

Adaptation requires long-term (approximately 30 or more years) planning and a steadfast commitment to the intended adaptation outcomes. With government's three-year budgetary framework, the separation of budgets by line function, operating with very small resource buffers and five-year IDPs, local governments are often not geared towards systemic and long-term thinking and planning (TAU and WCG, 2013). Instead, municipalities predominantly operate in a crisis-management mode that prohibits the opportunity for clear and rational long-term planning. This is exacerbated by a number of issues such

as the fact that financial and budget management operates on 12-month cycles. There are also complex procurement processes which favour short-term projects using well-established and low-cost methods and technologies, rather than experimenting with alternatives that might cost more initially but have been shown to be more effective in the long run (TAU and WCG, 2013). Frequent political leadership changes can prohibit effective and consistent long-term planning (as an example, Cape Town has had seven mayors in fourteen years). The same applies to political responses and the focus on immediate issues that are popular among the electorate, rather than being forward-looking and anticipatory, which is what climate change requires. Lastly, performance management systems often focus on and reward annual rather than long-term deliverables (TAU and WCG, 2013).

5.5.6. Tightly controlled financial management systems

The Local Government: Municipal Finance Management Act (MFMA) (RSA, 2003b), the Public Finance Management Act (RSA, 1999), the Municipal Public-Private Partnership Regulations (RSA, 2005b) and the Preferential Procurement Policy Framework Act (RSA, 2000b) are designed to build a transparent and accountable public sector financial management system. They have, however, resulted in unintended consequences, including: conservative financial interpretations of legislation (interpretation differences between and within public sector organisations); dependence on grants; an unwillingness to innovate; a dependence on old but proven technologies; and a short-term perspective to investment based on the three- to five-year Medium Term Expenditure Framework (De Visser, 2012; TAU and WCG, 2013). These tightly controlled financial management systems, the reality of limited municipal budgets and the urgency of everyday service delivery needs, reduce the incentive for creativity and innovation, which is often what is required to move into a 'business unusual' manner of working, departing from current practices in order to address climate-related challenges in a forward-looking and sustainable manner. Of particular concern is the expenditure mismanagement clause of the MFMA (RSA, 2003b), which holds an official criminally

liable for a poor investment decision, even if he/she took a calculated risk and acted in good faith. Given the legislative requirements and perceived risks of being accused of financial mismanagement, the transaction costs associated with adopting new technologies and/or innovative processes are high. These new technologies and processes may, however, enable more effective and efficient service delivery in the face of changing local climate conditions, for example in areas such as energy efficiency services and flood attenuation through the use of ecological infrastructure. It is therefore imperative that a more progressive interpretation of the MFMA (RSA, 2003b) and related legislation be promoted, especially by National Treasury, in order to unlock such innovation and urban climate adaptation within local government.

5.5.7. Lack of access to climate change adaptation financing

While South Africa has access to several forms of international climate finance, such as the Clean Development Mechanism, the Global Environmental Facility, the Global Climate Change Alliance (GCCA) and the United Nations Environment Programme (UNEP) and Clean Technology Funds, not all spheres of government are easily able to access these as yet (TAU and WCG, 2013). In some cases, national designated authorities are still being defined and in others, the processes are incredibly onerous on public sector bodies and/or public sector financial systems are not geared towards easily accepting and using these funds. In assessing current climate financing in South Africa, the DEA has identified that most climate action outside the energy generation sector remains marginal, lacking the scale and resources to drive major economic shifts. Resource mobilisation and the creation of enabling investment conditions to mainstream climate action therefore remain critical in the South African context.

A commitment is made in the NCCRP (RSA, 2011) to develop an enabling national finance system that both promotes access to new resources and mainstreams climate change response into the fiscal budgetary process. But this remains a work in progress. Until dedicated finances are available to

municipalities, climate change remains widely viewed within municipalities as an unfunded mandate (TAU and WCG, 2013). While dedicated climate funds are important, this should not preclude efforts to innovate within existing budgets.

5.5.8. Lingering scepticism and misconceptions of climate change

Early climate change concerns emerged out of the international earth sciences research community and the environmental lobby. As a result, the climate change agenda remains in the minds of many politicians and senior officials, in Cape Town and the world over, a green or environmental issue and by some extremist, alarmist and anti-development. Globally, initial efforts were focused almost entirely on climate change mitigation through reducing the emission of greenhouse gases. This has left many political leaders with the view that climate change can be avoided or 'fixed', that technology is the way to address the climate change challenge and that reducing electricity consumption will avoid climate risks. Other misperceptions repeatedly encountered amongst local government officials and political representatives alike are that mitigation and adaptation are inter-changeable terms and that climate change is a global issue that needs to be addressed and funded at the global or national scale, not in the realm of local government. This has fuelled a persistent and pernicious reticence to engage with questions of climate change within many local governments. However, this is starting to change as it is increasingly being recognised that businesses and local governments can, need to and in some places already do, lead the way in driving climate action in terms of both mitigation and adaptation.

5.5.9. Climate change is a wicked problem

Probably the greatest challenge to implementing effective urban climate adaptation measures in South African cities and municipalities is that climate change and its effects are often not readily tangible and

immediate. Climate change is often communicated as projections of future climate conditions over large spatial areas for the middle and end of the century, and as a result climate change is perceived by many as being far in the future and removed from current development challenges in South African cities. This translates into a lack of urgency in responding to climate change, especially by local governments facing severe budgetary constraints in the face of mounting pressures to meet basic service delivery needs.

So despite a potentially conducive and enabling policy and legislative framework, the governance challenges facing local government, discussed above, have contributed to climate change adaptation not yet gaining much traction in core decision-making processes and operational practices at the local government level in most South African cities. This adds to the impetus for this study to better understand how urban climate adaptation can and does play out, in support of furthering both climate adaptation theory and implementation.

5.6. Conclusion

This chapter describes how South African cities are particularly susceptible to climate impacts because of imprudent spatial planning and development, high levels of poverty and informality, infrastructure deficits, service delivery backlogs, and a resource-intensive urban form. The chapter considers, primarily from a local government practitioner perspective, the role in urban climate adaptation that South African local governments are enabled or required to play by the existing law and policy framework. The review shows that there exists an extensive set of legal and policy provisions and mandates for urban climate adaptation led by local government. However, these remain fragmented and currently do not provide a sound basis from which to drive adaptation interventions. Local governments therefore have to voluntarily piece together components of various national policies and legislation to

make the case for addressing climate change and develop a practical approach for doing so (Roberts, 2008 and 2010; Roberts et al., 2012; Cartwright et al., 2012a). There are numerous political, socio-economic and organisational realities that hinder existing attempts by local governments to plan and implement climate adaptation measures in South Africa's cities (Ziervogel and Parnell, 2012; Leck and Roberts, 2015; Taylor, 2016). So even though many city governments have begun designing urban climate adaptation measures, they face a range of challenges in implementing these measures and achieving results in terms of reduced climate vulnerability, risks and impacts. Consequently, any developments to strengthen existing legal and policy tools aimed at furthering the urban climate agenda in South African cities need to be accompanied by organisational change, including political, fiscal and administrative innovation, within the local government sphere. It is the governance complexities, forming the wider legal and institutional context for technical, administrative and political decision making at the local government level, that are further investigated in this dissertation through applying a process lens to climate adaptation in Cape Town. In the following chapter the particular context of Cape Town is introduced from an urban development, climate and governance perspective.

Chapter 6: Cape Town's climate adaptation context

6.1. Introduction

The previous chapter focuses on the national context of South African cities and the opportunities and challenges facing city governments in South Africa for driving urban climate adaptation. Before delving into the details of three climate adaptation decision-making processes within Cape Town's local government, this chapter provides contextual information by describing the main features of Cape Town's urban development, its local climate and the ways in which climate and development intersect in Cape Town. The chapter then introduces the array of actors and governance arrangements within which the local government operates and provides an overview of the various efforts led by Cape Town's local government to explore and implement both climate adaptation and mitigation interventions. This provides the background against which the three process case studies analysed in the subsequent chapters are to be viewed and understood.

6.2. Development context of Cape Town

Situated on the coast between two mountain ranges, with a long history of settlement, Cape Town is a city characterised by biophysical and socio-cultural diversity. High levels of socio-economic inequality and spatial fragmentation are also a striking feature. The CCT is a metropolitan municipality spanning an area of the 2359 km^2 (CCT, 2014a), as shown in figure 6 (CCT, 2011b). Cape Town has a population of approximately 3.86 million (CCT, 2014b), making it the tenth most populous city in Africa[4] (UN Habitat, 2014) and the second in South Africa, after Johannesburg. The city's population has grown by 45% in the

[4] Lagos (13,1 million); Cairo (11,9 million); Kinshasa (10,3 million); Khartoum (5,2 million) Abidjan (4,9 million); Dar es Salaam (4,4 million); Johannesburg (4,1 million); Nairobi (4,0 million); Kano (3,9 million)

last 15 years, associated with rising demand for land, housing, energy, water and other services such as sanitation, transport and education (CCT, 2014b). This in addition to unmet demand in areas with a long history of underservicing.

Figure 6: Map of Cape Town showing the municipal boundary, developed areas and protected areas

6.2.1. Poverty and inequality

Levels of socio-economic inequality remain exceptionally high in South Africa, a legacy of the Apartheid regime. Cape Town is no exception with a Gini co-efficient[5] of 0.64, indicating very high levels of income inequality (CCT, 2015a). Poverty in Cape Town remains widespread. The number of indigent households in Cape Town increased from 250,000 in 2003 to 288,703 in 2013[6] (CCT, 2014a).

6.2.2. Economy

Cape Town has the country's second largest municipal economy after Johannesburg (Turok and Borel-Saladin, 2013). Cape Town's economy accounted for 11.3% of South Africa's GDP in 2012 (CCT, 2014b) and approximately 73% of the Western Cape GDP in 2013 (Western Cape Government Provincial Treasury, 2015). Cape Town's real GDP per capita in 2012 was R58,844, comparing favourably with a national figure of R37,404 and an average among South Africa's metropolitan municipalities of R55,167 (CCT, 2014b). Cape Town is a hub of agricultural processing[7] and export, with the second busiest container port in South Africa, after Durban. The city also contains a host of scenic beauty spots and natural attractions that underpin a growing tourism industry. However, as figure 7 (CCT, 2014b, p.105) shows, the finance sector constitutes the largest contributor to Cape Town's local economy, measured as a

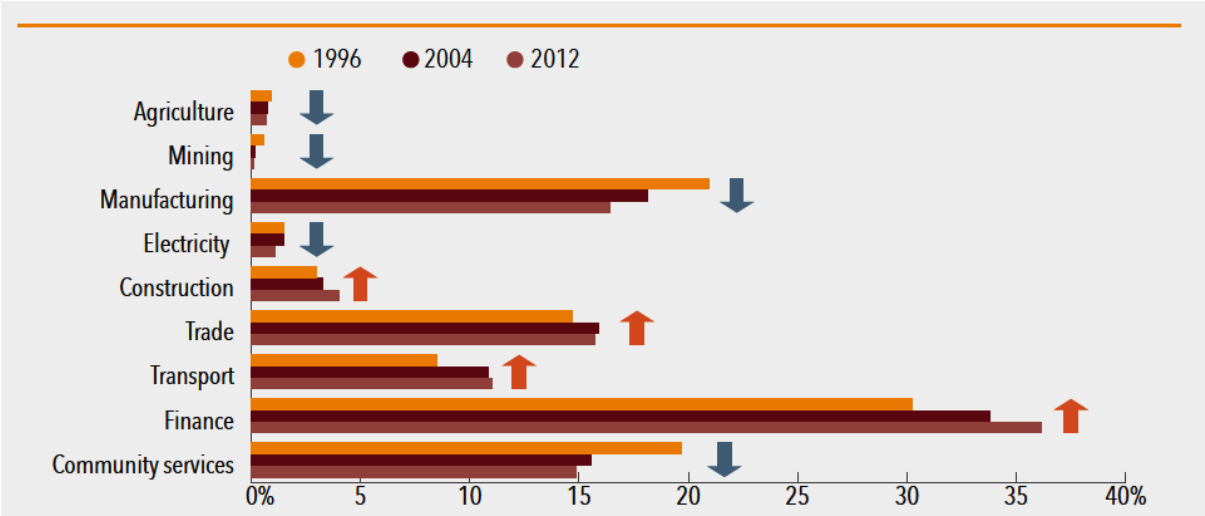
[5] A Gini coefficient of 1 means all income belongs to a single individual, while a coefficient of 0 means that every resident has an equal share. South Africa's national Gini coefficient ranges from 0.66 to 0.7, depending on the dataset and time period used (Statistics SA, 2014).

[6] Households who qualify for a Reconstruction and Development (RDP) or Breaking New Ground (BNG) house form the proxy baseline for determining indigence in Cape Town. Any household earning R3 500 or less per month qualified for an RDP or BNG house in 2011. Since the Census data had a cut-off point at R3 200 per month only (and not R3 500) CCT used this figure as the poverty line in 2011.

7 Food and Beverage production is Cape Town's largest manufacturing industry, contributing R9,8 billion (3,6%) of the city's output.

proportion of gross domestic product (GDP). The structure of Cape Town's economy has moved steadily away from the productive sectors towards specialised service sectors[8] (CCT, 2014b).

Figure 7: Cape Town's change in sector share of GDP between 1996, 2004 and 2012



6.2.3. Employment

The number of jobs in Cape Town's manufacturing sector is significantly declining, while the finance, transport, trade and construction sectors have created new jobs in recent years (CCT, 2014b). As labour force growth has exceeded employment growth, the strict unemployment rate in Cape Town increased from 19.2% to 24.9% between 2005 and 2013 (CCT, 2014b). The informal sector in Cape Town is estimated to account for 9 to 11% of people in employment (CCT, 2014b), a very small figure compared to most other African cities. For example, in Dakar, Senegal, and in Bamako, Mali, as many as 79.8% and 82.1% of workers employed in non-agricultural sectors work in the informal economy respectively (UN Habitat, 2014).

[8] Other key service sectors contributing to Cape Town's local economy include real estate, business process outsourcing, auditing, architecture and engineering.

6.2.4. Spatial density and transport

Cape Town is a low-density city with a sprawling spatial form and poorly integrated land use pattern (Ewing and Mammon, 2010). The Siemens Green City Index, developed by the Economist Intelligence Unit (2012), found Cape Town to be the second least densely populated amongst the 15 African cities included in the study[9]. Cape Town's density figure was estimated at 1500 persons/km^2, far below the average density across all 15 African cities of 4600 persons/km^2, in turn well below the 8200 persons/km^2 average density of 22 Asian cities included in the study (Economist Intelligence Unit, 2012). Because of this low density and urban sprawl, many Cape Town residents have poor access to economic opportunities and services, and commute long distances. While government is making large investments in improving public transport services, notably through the phased roll out of a bus rapid transit system, elements of the public transport system are not in local government control or mandate. 48% of residents still rely on private vehicles (CCT, 2015b). Ownership of light passenger vehicles has doubled over the past 15 years in Cape Town, leading to growing congestion and vehicle emissions, as discussed in section 4.4 (CCT, 2015c).

6.2.5. Local government

The CCT local government has executive and legislative authority in the municipal area. In terms of the Constitutional requirement of cooperative governance, the CCT must ensure that all its policies, strategies and plans align with national and Western Cape provincial legislation and policy. Since 1994, Cape Town's local government has been through numerous phases of integration and restructuring. Sixty-one local, racially segregated municipalities with different functions and levels of political authority were

[9] Cities included in the African Green City Index: Accra, Ghana; Addis Ababa, Ethiopia; Alexandria, Egypt; Cairo, Egypt; Cape Town, South Africa; Casablanca, Morocco; Dar es Salaam, Tanzania; Durban, South Africa; Johannesburg, South Africa; Lagos, Nigeria; Luanda, Angola; Maputo, Mozambique; Nairobi, Kenya; Pretoria, South Africa; Tunis, Tunisia.

ultimately unified into one metropolitan municipality in December 2000, guided by the Municipal Structures and Systems Acts (RSA, 1998c; RSA, 2000; Jaglin, 2004). Through this restructuring there was a devolution of government functions from the national to local level and the service delivery approach shifted to focus on public-private partnerships, cost recovery and performance management systems (Watson, 2002; Swilling and de Wit, 2010).

The CCT currently consists of 231 politically elected City councillors, led by an Executive Mayor, that constitute the City Council; and approximately 27,000 City officials, headed by a City Manager, employed within the City administration. Currently the Democratic Alliance, South Africa's main opposition political party at the national level, has a 66.6% majority to lead Cape Town's City Council. In the last few years, the CCT has worked to streamline policy development across public service domains and facilitate transversal management to enable more effective service delivery and the realisation of priority agendas.

6.2.6. Service delivery

By South African and African city standards, Cape Town compares favourably when it comes to levels of public services provision. Census data from 2011 suggest that approximately 97% of Cape Town's households have access to basic public services according to nationally stipulated minimum standards (CCT, 2014a). However, unpacking the details reveals a significant number of households in Cape Town living in extremely poorly serviced conditions. In 2014/15 an estimated: 30 000 households had no access to water or access that is more than 200m from their yard; 74 800 households only had access to a bucket toilet or no sanitation at all; 22 000 households used their own refuse dump and/or had no refuse disposal; and 36 316 households were without basic access to electricity (CCT, 2014a).

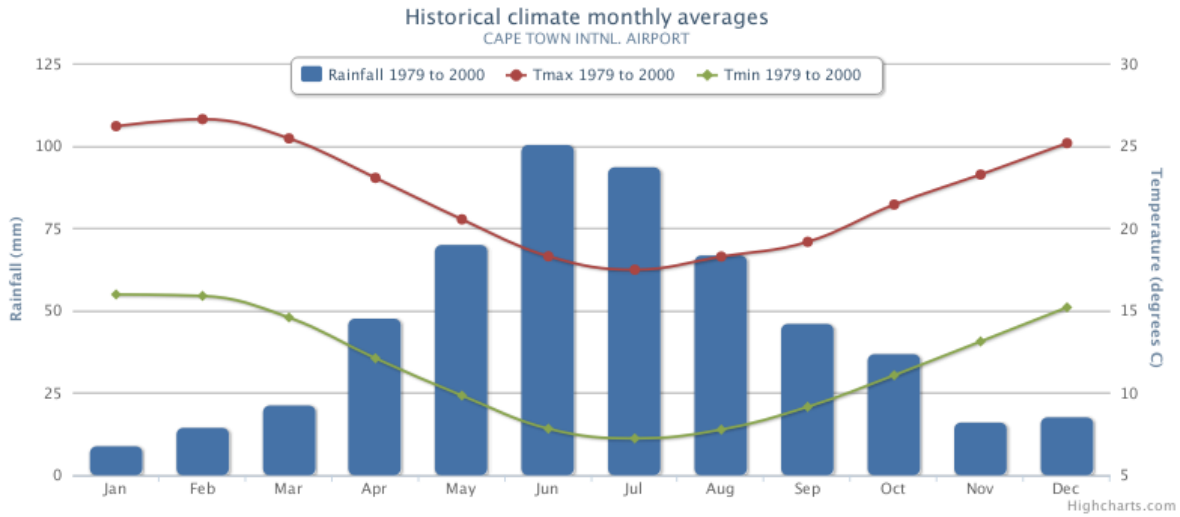
6.2.7. Ecosystems

With over 300km of coastline and a mix of mountain and lowland areas, Cape Town incorporates a range of natural and semi-natural open spaces and a diversity of terrestrial and aquatic ecosystems. Situated within the Cape Floristic Region, the smallest of the world's six floral kingdoms, Cape Town is a biodiversity hotspot of global significance. However, many endemic species are under threat of extinction (Holmes et al, 2012; Rebelo et al, 2011). The conservation of these species, and the ecosystems they form part of, is difficult owing to pressure on land for housing and commercial interests, driven by urban and economic growth. On the other hand, Cape Town's tourism industry is largely reliant on the health and attractiveness of these natural assets. In addition, natural systems such as wetlands, rivers and costal dunes play an important role in buffering the city from extreme weather and climate events.

6.3. Cape Town's climate context

Cape Town has a Mediterranean climate with warm, dry summers and cool, wet winters. This sets Cape Town apart from the other large cities in South Africa, all of which have sub-tropical, summer rainfall climates. The seasonal climate cycle experienced in Cape Town is largely driven by the presence of the South Atlantic high-pressure system during the summer and passing mid-latitude cyclones in the winter that bring cold fronts, rain and stormy seas (Tadross et al., 2012). Figure 8 shows the seasonal cycle based on historical data (1979-2000) collected at the Cape Town International Airport. The narrow seasonal temperature range highlights the moderating effect of the ocean on Cape Town's climate.

Figure 8: Monthly averages of total rainfall, maximum temperature and minimum temperature for 1979 to 2000 at the Cape Town International Airport weather station



What the historical climate averages in figure 8 (Climate Information Portal, accessed 15 February 2016) do not show is the high variability of conditions between years and between different locations within the city. For example, the longer record at the Cape Town International Airport (from 1841 to 2006), shows total annual rainfall ranging from 229mm to 1037mm (Adelana et al., 2010). A comparison of data collected at the airport inland and at a coastal station on Cape Point shows considerable differences, for example a recorded average annual rainfall of 539.9mm and 355.17mm respectively[10]. It is in times and places of extreme rainfall and/or temperatures that adverse impacts are experienced. Climate impacts faced in Cape Town are discussed in section 4. The severity, frequency and/or duration of such extreme events are changing due to increasing global concentrations of greenhouse gases (GHGs) in the atmosphere. The latest climate change projections undertaken for Cape Town recommends preparing in earnest for a drier warmer future over the coming decades: "*…the evidence for drying and warming is strong and planning that ignores this evidence is at significant risk of vulnerability to a changing climate. There is now sufficient science evidence to motivate for serious consideration of climate adaptation planning and implementation in the city*" (CSAG, 2016, p.2). Understanding changes in the

[10] Data available through the Climate Information Portal, URL: http://cip.csag.uct.ac.za/, accessed 15 February 2016.

local climate requires looking both at trends in historical climate records and at projections of the future climate.

6.3.1. Past trends

A study of rainfall and temperature records for 1960 to 2010 at the South African Astronomical Observatory found that recent decades have, on average, been warmer than the preceding ones, and rainfall events have been less frequent but more intense than in the past (Tadross and Johnston, 2012). A more recent study, commissioned by the CCT, covering the broader Cape Town region using surrogate datasets (i.e. not station data) also shows a clear warming trend (CSAG, 2016). The rainfall picture is mixed. The long-term trends in rainfall (1901 – present) show an overall increase in rainfall in the north of the Cape Town region and a decline in the southern part. The mid-term (1979-2013) trends in annual rainfall show slight, although not statistically significant, drying (CSAG, 2016). While changes in the local climate are thereby already evident in the records, they are much clearer for temperature than for rainfall.

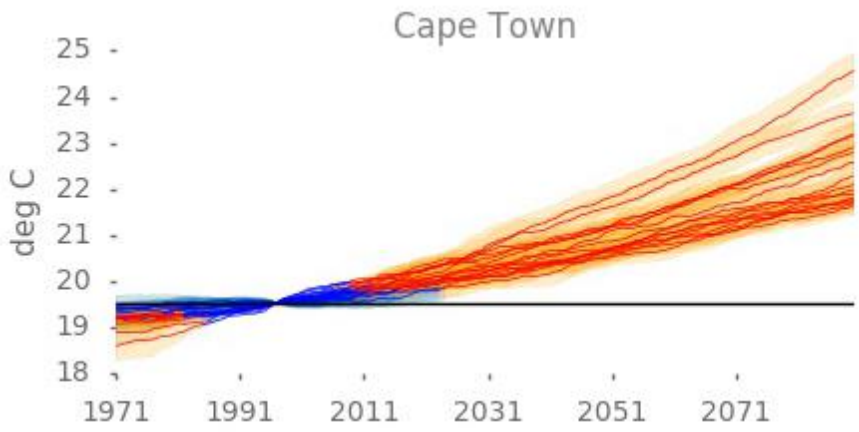
6.3.2. Future projections from global models

Figures 4 and 5 show simulated temperature and rainfall trends for the Cape Town area (see spatial delineation in CSAG 2016 report)[11]. The black line shows the mean value across all models in the reference period 1986-2005. The colour lines show the 20-year moving average of results from each model and the shading around each line shows the 95% confidence range around those model results. Where the line and associated shading changes from blue to red indicates statistically significantly changes

[11] As simulated and projected by CMIP5 GCMs for RCP 8.5. CMIP5 is the fifth set of experiments run in the Coupled Model Inter-comparison Project. RCP 8.5 is the Representative Concentration Pathway depicting an increase in greenhouse gases resulting in an equivalent increase in solar radiation of 8.5 Watts per square meter at the top of the atmosphere by 2100.

from the reference period. This indicates the likelihood of climate events occurring that are historically unprecedented. Figure 9 (CSAG, 2016, p.28) shows that climate change is already (from 2010-2015) resulting in temperatures that exceed the range of climate variability simulated between 1986-2005 for Cape Town. Results over the Cape Town region from multiple General Circulation Models (GCMs) show a clear continued pattern of warming in the temperature projections, ranging from 1 to 2 degrees Celsius by the 2050s and 2 to 5 degrees by the end of the century (Tadross and Johnston, 2012; CSAG, 2016).

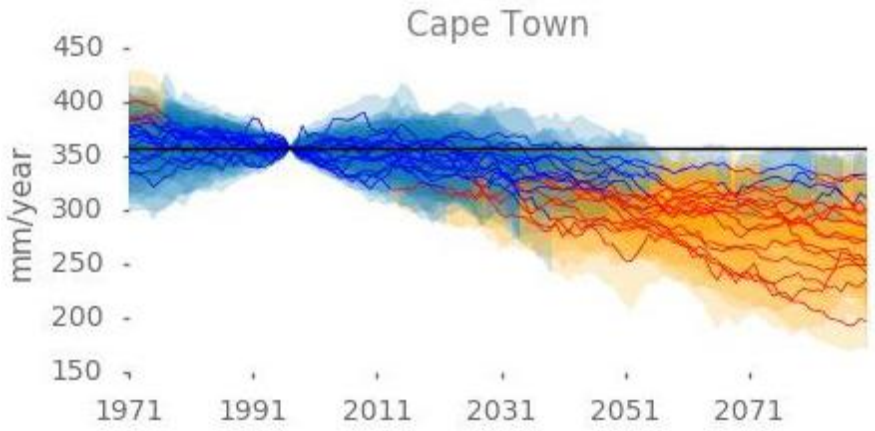
Figure 9: Temporal evolution of yearly mean of daily maximum temperature from CMIP5 GCMs for RCP8.5



The rainfall picture across the GCMs shows a continuation of natural variability until around 2030-2040 followed by a shift towards a drier future, ranging from small reductions through to as much as a 50% reduction in rainfall, as shown in figure 10 (CSAG, 2016, p.28) [12]. The strongest reduction in rainfall is projected for autumn and winter.

[12] A performance analysis of the GCMs shows that none of the models perform markedly worse than the others in simulating Cape Town's climate, therefore there is no justification at this stage to discount any or assume one set of model results (i.e. one line on the plume plot) is more or less likely than another (CSAG, 2016).

Figure 10: Temporal evolution of annual total rainfall from CMIP5 GCMs for RCP8.5



6.3.3. Downscaled future projections

The results from statistically downscaling[13] the projections made by CMIP5 GCMs show similar patterns of projected warming over Cape Town, associated with increases in the number of extreme hot days and heat spell duration (CSAG, 2016 and the Climate Information Portal). The downscaled rainfall projections, however, differ from the GCM projections showing an almost equal split between a wetter future and a drier future, ranging from a 20% decrease to a 20% increase by the 2050s. An initial analysis suggests that the downscaling approach used is potentially failing to capture drivers of rainfall variability and change. Consequently, along with clear warming trends, the potential of reduced rainfall in the future shown by GCM results should factor into planning, while acknowledging that the statistical downscaling continues to show a mixed picture (CSAG, 2016).

Because Cape Town relies on resources drawn from across the wider Western Cape region, notably water and agricultural products, it is not only the climate within the boundaries of the city, but

[13] Statistical downscaling uses historical records of rainfall and temperature as well as histories of circulation patterns to calibrate a statistical model relating circulation patterns to local responses.

that of the wider region that impact the city's functioning. Climate data from across the Western Cape region also consistently show trends of warming in the historical record and in the future climate projections, with inland areas warming more than the coastal areas (CSAG, 2014). The rainfall projections for the wider region are also varied. Projections point to possible aggregate drying in the region, but some models and locations show future wetting (CSAG, 2014).

6.3.4. Overall climate picture

In sum, the available climate information shows clear evidence of increasing temperatures in the historical records, continuing to rise in the future projections across Cape Town and the broader Western Cape region, with inland areas warming more than coastal areas. This average temperature increase is associated with more extreme hot days, as well as less extreme cold temperatures, with notable impacts on health, agricultural production, water availability and energy demand. Rainfall patterns are more varied. There are signs in some station records of dry spells (i.e. number of days between rainfall events) increasing and rainfall events becoming more intense in recent decades. Projections of future rainfall from GCMs show annual totals remaining within the 1986-2005 natural variability range until the 2030-2040 period, followed by significant drying, especially in autumn and winter. The downscaled models show potential for either an increase or a decrease in rainfall. This remains a crucial area for further research. The challenge of developing detailed climate information at the city scale is not limited to Cape Town. It is an area of international scientific research, as described in chapter 1, requiring increased investment in data collection and analysis.

As a coastal city, Cape Town is not only susceptible to and impacted by changes in the atmospheric climate conditions but is also impacted by changes in ocean conditions, particularly the mean sea level and the size of storm surges. An analysis of historical sea level records for the Cape Peninsula suggests an

accelerating increase in local mean sea level that is consistent with global estimates of an average rate of increase of 1.8 [1.3 to 2.3] mm per year since 1961 and an increase of 3.1 [2.4 to 3.8] mm per year since 1993 (Brundrit, 2008). As such, managing Cape Town's coastal areas for adapting to an accelerating rise in sea levels and more intense storm surges will also prove critical to sustainable development.

6.4. Intersections between Cape Town's climate and development

The ways in which the city is growing and developing contributes to the impact that human activities have on the global climate. The development of the city also directly affects the extent to and ways in which people and natural systems in the city can cope with and adapt to changes in climate conditions. These intersections between climate and urban development in the case of Cape Town are the focus of this section.

6.4.1. Climate impacts and associated costs

The range of climate conditions currently experienced in Cape Town periodically leads to costly impacts. The evidence for continued warming and future drying is strong and planning that ignores this evidence is ill-informed (CSAG, 2016). Without significant and timeous adaptation action, direct climate impacts are likely to include: water stress in times of drought; fires in the dry, hot season; flooding triggered by heavy rainfall; coastal erosion and inundation caused by large winter storms and associated sea surges; damage to homes and public infrastructure from heavy winds and wind-blown sand); health threats from high temperatures and high concentrations of air pollution; and species loss that reduces local biodiversity and undermines the functioning of ecosystems (CCT, 2006; Mukheibir and Ziervogel, 2007). Many of these impacts have been experienced in the past and may intensify unless preventative action is taken.

Climate impacts in turn create secondary impacts on the local economy and by extension the provincial economy. The Port of Cape Town and smaller harbours may be able to operate for less days of the year and transport infrastructure may be blocked, damaged or destroyed. The quantity and quality of water, a critical resource underpinning the economy, is under increasing threat as the climate warms and gets drier and the city grows (Ziervogel et al., 2010). Agricultural productivity is compromised by changes in temperature and rainfall patterns, affecting the availability and cost of food, the export of agricultural products, and the profitability of Cape Town's agro-processing industry. Health impacts and disaster events are associated with reduced worker productivity, lower school attendance and an increased burden on the public healthcare service. Costly damages could lead to losses in the insurance sector, which in turn affect premiums and insurability. Deterioration of the city's ecosystems affect functions and services such as flood attenuation, water cleansing and recreational space, as well as compromising the scenic attractions that underpin the tourism industry. Repairing damages to physical infrastructure such as roads, railway lines, parking areas, pipes and electrical lines from high winds, flooding, wind-blown sand and extreme high temperatures is a drain on already stretched government budgets. Costly repairs to private properties disproportionately impact the budgets and profitability of poor households and small businesses, also affecting the affordability of insurance. For example, a large flood in August 2004 required emergency relief costing R2.2 million and resulted in R4.3 million in reported insurance claims (DiMP, 2010).

The full extent of climate risks to and impacts on Cape Town's economy (under a range of scenarios, for all affected sectors) has not been quantified. Methodologies for doing such city-scale economic impact assessments are an area of active research. Studies that have been undertaken, mostly in European and North American cities, show vast costs associated with climate impacts across the urban

system (Hunt and Watkiss, 2011; Hallegate et al., 2011; Kirshen et al., 2008). An assessment of sea level rise risk for Cape Town found that over the next 25 years[14] the area seaward of the 2.5m contour is highly vulnerable to flooding from storm surge events. In the event that the 2.5m or 4.5m contour is flooded, infrastructure to the value of R5.2 billion and R23.8 billion respectively would be exposed (Cartwright, 2008)[15].

6.4.2. Vulnerability to impacts

The vulnerability of people and natural systems to climate impacts and associated damages and losses is not evenly distributed across Cape Town, either spatially or socio-economically. For example, heat waves are known to have particularly severe effects on people with suppressed or under-developed immune systems, namely children, the elderly and those with pre-existing health conditions, such as HIV/AIDS and tuberculosis. Furthermore, droughts creating water scarcity and food insecurity affect the city as a whole, but not everyone is equally impacted. A spike in food prices hits the city's poorest households hardest and it is individuals with fragile or compromised health that are impacted worst by a decline in the nutritional value of their food intake. This points to the multiple and complex interlinkages between Cape Town's climate and development conditions.

A comprehensive city-scale climate vulnerability assessment has yet to be done for Cape Town. This is an important step in identifying how to tailor, target and sequence adaptation and risk

[14] Wave run-up measured with a differential GPS from a storm surge on the 31st of August 2008 indicated that both these scenarios have already taken place.

[15] These cost estimates are based on the theoretical assumption that the entire coastline would be inundated in both scenarios. Cape Town's coastline is not, however, homogenous and flooding events will take place on a discreet basis in 'pockets'. The nature and spatial extent of the flood event will also be influenced by the particular characteristics of storm surges, e.g. wind and swell direction, significant wave height and timing in relation to tidal fluctuations.

management interventions within the city, especially in light of scarce and limited resources to do such work. Ideally, a vulnerability assessment should help in answering questions around where to target interventions, i.e. spatial focus; who to target, i.e. demographic or socio-economic focus; and what to target, i.e. what elements and relations within the urban system are potentially important leverage points for intervention.

6.4.3. Declining biodiversity and ecosystem functioning

While many species have the ability to adapt and migrate in response to changing temperature, rainfall and wind patterns, their persistence is challenged by habitat loss and fragmentation caused by increasing urbanisation and the conversion of open land into built environment (Rebelo et al., 2011; Holmes et al., 2012). Cape Town's growth has resulted in habitat fragmentation and destruction, placing numerous species under considerable threat of population collapse, driving biodiversity loss. The loss of ecosystem functioning decreases the extent to which ecosystems provide a buffer to the human impacts of climate change, e.g. flood attenuation and water filtering.

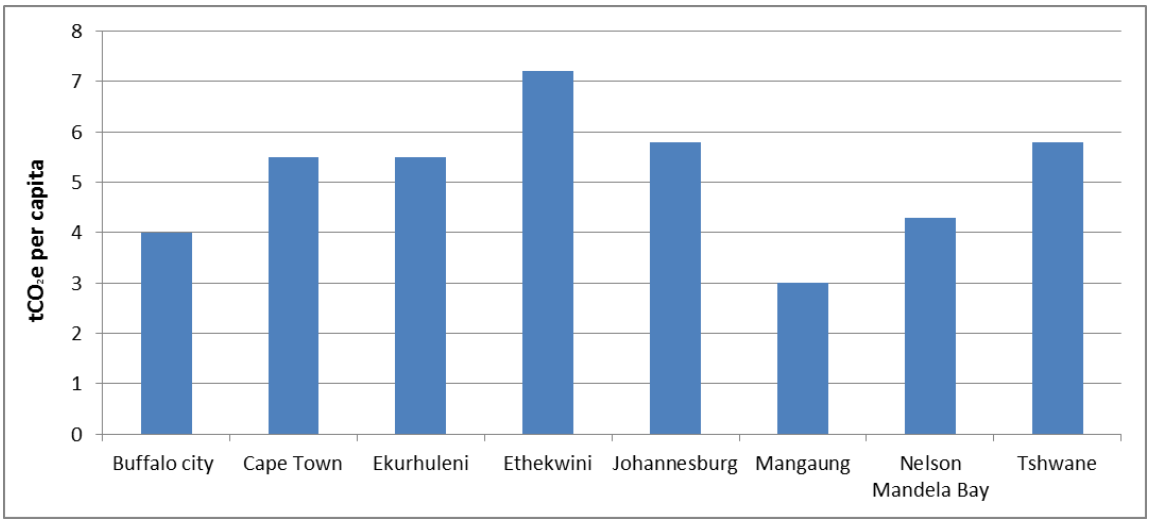
6.4.4. Cape Town's emissions contributing to climate change

The extent to which climate impacts are experienced and climate adaptation is needed depends on the nature of Cape Town's development and on how much the global climate, and thereby the local climate, changes. The latter depends on the cumulative levels of greenhouse gases (GHG) emitted globally. Cape Town's development in relation to climate change therefore needs to focus not only on impacts and adaptation, but also on Cape Town's contributions GHG emissions, particularly in light of South Africa's nationally determined mitigation contributions under the UNFCCC.

Cape Town's GHG emissions in 2012, including marine and aviation fuels, were 5.55 tCO_2e per capita (CCT, 2015c). This positions Cape Town as a medium to high emitter when compared with other cities globally. For example, Cape Town's per capita emissions are higher than Stockholm, Sweden, at 3.6 tCO_2e per capita but lower than Beijing, China, at 10.8 tCO_2e per capita[16] (CCT, 2015c). In terms of national benchmarking, Cape Town's per capita emissions figure is similar to the other major South African metropolitan municipalities of Johannesburg, Tshwane and Ekurhuleni, as shown in figure 11 (CCT, 2015c, p.51). EThekwini has a higher per-capita footprint, partly due to its large industrial port (CCT, 2015c). Cape Town's high carbon footprint is largely a result of the city's energy supply being primarily fossil fuel based (i.e. coal and oil), the city's sprawling and poorly integrated urban layout that leads to considerable transport demands, and a poor public transport system. In terms of sectoral contributions, transport dominates, accounting for 33% of the city's GHG emissions in 2012, followed by the commercial (26%), residential (22%) and industrial (11%) sectors (CCT, 2015c). Emissions generated by the operations of Cape Town's municipal government accounted for 2% (CCT, 2015c). While the city's emissions continue to grow year on year, the rate of growth has declined (CCT, 2015c). Climate change mitigation efforts aimed at reducing the city's GHG emissions are therefore focussed on: improving energy efficiency across all sectors; investing in public transport; encouraging compact forms of urban growth and development to reduce sprawl; and increasing the amount of renewable energy within the national and local energy production mix (CCT, 2015c).

[16] Data from 2005 and 2006 for Stockholm and Beijing respectively.

Figure 11: Energy-related GHG per capita for South African metros, 2012



6.5. Governing climate and development in Cape Town

The above sections have highlighted the interconnected development and climate challenges facing Cape Town. The shift towards a more sustainable and climate resilient development trajectory is complex and takes time. Various efforts are already underway to explore and implement adaptation and mitigation interventions. To contextualise the forthcoming chapters, which describe many such interventions in detail, this section provides an overview of who is doing what to address climate and development issues in Cape Town, with a primary focus on local government.

6.5.1. Key climate change role-players in Cape Town

Concerns around tackling climate change surfaced in Cape Town in the late 1990s and early 2000s. Work on energy and carbon emissions in South African cities, including Cape Town, under the Sustainable Energy for Environment and Development (SEED) programme was an important contributor to establishing the climate change agenda locally (Borchers et al., 2008). So too was the work of ICLEI - Local

Governments for Sustainability[17], an international association of local governments and local government organisations committed to sustainability. ICLEI established their Africa regional secretariat in Cape Town, in partnership with and hosted by CCT. The CCT's 2001 Integrated Metropolitan Environment Policy contained the first official mention by local government of climate change concerns for Cape Town. This led to developing an Energy and Climate Change Strategy and Framework for Adaptation to Climate Change in the CCT (FAC4T). Both were finalised in 2006, supported by Sustainable Energy Africa (SEA), UCT's Energy Research Centre (ERC) and Climate Systems Analysis Group (CSAG). From these flowed the Energy and Climate Action Plan in 2009, Cape Town's Energy Futures Study in 2005 and updated in 2011, the development of sectoral Climate Adaptation Plans of Action (CAPAs), and the Global Sea Level Rise Risk Assessment for the CCT study (Brundrit 2008; Colenbrander et al., 2015; Taylor, 2016). In 2009, the Cape Town Climate Change Think Tank was established to further advance climate change research, policy and practice in Cape Town. This was a multi-stakeholder forum for commissioning and reviewing key pieces of research on various local dimensions of climate change, led by CCT and UCT's ACC (Cartwright et al., 2012b). This gave rise to the MUF partnership between CCT and ACC, through which collaborative research and writing was undertaken on various aspects of urban sustainability, including climate change adaptation, energy governance and low carbon, resilient economic growth (Patel et al., 2015).

In parallel, significant work was underway in the disaster risk management space in Cape Town also tackling questions around climate hazards and the changing nature of such hazards. The research and consultancy work of UCT's Disaster Mitigation Programme (DiMP), which became the Research Alliance for Disaster Risk Reduction (RADAR) at Stellenbosch University, made an important contribution by highlighting the risks and vulnerabilities of people and places in Cape Town to climate-related hazards (DiMP, 2005; Holloway and Roomaney, 2008; Holloway et al., 2010).

[17] Previously named the International Council for Local Environmental Initiatives (ICLEI).

Other research groups[18] and non-governmental organisations[19] have been important advocates of and contributors to strengthening the climate change agenda in Cape Town. International networks and agreements have also played a key role. The CCT is a signatory to and member of: The Cape Town – Aachen Partnership (2005); the Mexico City Pact (2010); the Durban Adaptation Charter (2011); the C40 Climate Leadership Group (2014); the Compact of Mayors (2015); the 50 Municipal Climate Partnerships Programme (2015); and the 100 Resilient Cities Network (2016)[20]. Compared to many cities within South Africa and across the African continent, Cape Town has a relatively high concentration of organisations working on climate change issues and level of international exposure. Various efforts have been initiated to strengthen and coordinate the network of local actors, such as the Cape Town Climate Change Think Tank mentioned earlier, and the Cape Town Climate Change Coalition[21]. Despite this, a lack of well-resourced and continuous leadership and coordination has meant that much of the capacity to act on climate change in a way that changes the development trajectory of the city as a whole to be more sustainable, resilient and low-carbon has yet to be fully realised.

6.5.2. Climate adaptation led by local government

Various disaster risk assessments have been undertaken for Cape Town that point to climate change as a key hazard and a compounding factor in a large number of the risks facing Cape Town. This

[18] Such as the Sustainability Institute at Stellenbosch University, UCT's African Climate and Development Institute, the South African Biodiversity Initiative (SANBI) and the local branch of the Cambridge Institute for Sustainability Leadership.

[19] Including the Environmental Monitoring Group (EMG), the World-Wide Fund for Nature (WWF), and SouthSouthNorth (SSN).

[20] Dates in parentheses indicate when Cape Town joined.

[21] The Cape Town Climate Change Coalition was launched in 2011 to support Cape Town's bid to host COP 17, the 17th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). It represents an alliance of Cape Town-based organisations, including private sector, governmental and non-governmental organisations, researchers and educators. The partners agreed to continue working together to build Cape Town citizens' understanding of and commitment to addressing climate change issues.

mirrors a global assessment of risks by the World Economic Forum (WEF) ranking climate change as the number one risk with the greatest potential impact in 2016 and third highest in likelihood of occurrence (WEF, 2016). CCT has established an agreement with the South African Weather Services to get notified of developing extreme weather condition to enable early warnings to be issued and disaster preparedness. The CCT runs an intensive public awareness programme, particularly amongst high risk communities, on what hazards to look out for and how to protect against and prepare for the impacts of these hazards.

Work by the CCT to reduce climate risks has largely taken place under the banner of nine sectoral CAPAs[22]. The CAPAs have not necessarily driven the work, but have been an attempt at co-ordinating adaptation activities across local government. Water-related projects with a climate adaptation benefit have included: detailed flood mapping of key catchments to include climate change projections; adjusting the stormwater planning and infrastructure design to accommodate an increase in rainfall intensity; mapping informal settlements at risk of flooding to target flood protection interventions; the inclusion of water sensitive urban design principles in key policies; the implementation of a water conservation and water demand management programme; and feasibility studies for alternative water supplies, including the use of groundwater and desalination. On the biodiversity front, the Local Biodiversity Strategy and Action Plan and biodiversity network (BioNet) have integrated climate change considerations and the CCT runs a very effective invasive species management unit, improving water flows, protecting biodiversity and reducing fire risks. To manage climate risks relating to infrastructure networks and urban growth, work has been done to: develop a framework of Resource Efficiency Criteria for Development in Cape Town; develop an Integrated Coastal Management Policy and Plan; define coastal setback lines to reduce

[22] Sectoral CAPAs have been developed for: Biodiversity Management; Catchment, River & Stormwater Management; Coastal Management; Disaster Risk Management; Health; Human Settlements; Planning; Transport & Roads; and Water & Sanitation. For details on the development of the CAPAs see Taylor (2016).

the risks associated with sea level rise and storm surges; and map transport infrastructure and networks at risk. While some work has started, there is still much to do to develop a full picture of climate risks to infrastructure and to design, construct and maintain key infrastructure to withstand increases in temperatures, rainfall intensity, coastal inundation and changes in wind patterns.

6.5.3. Climate change mitigation in Cape Town

CCT's work to reduce GHG emissions has largely taken place under the banner of the Energy and Climate Action Plan (ECAP). Key projects include: retrofitting municipal buildings, streetlights and traffic lights to improve energy efficiency; installing rooftop PV on CCT buildings; reducing the emissions of the CCT's vehicle fleet; developing an internal energy management policy and protocol; retrofitting ceilings in low cost housing; developing a low income energy services strategy; running an electricity savings campaign[23]; developing an accreditation programme for solar water heater service providers; and establishing a commercial energy efficiency forum. On the energy production and reticulation front, CCT has worked with others to: establish a feed-in tariff for small-scale renewable energy producers; undertake smart metering and develop smart grids; and secure the supply of liquefied natural gas to the Western Cape. In terms of waste management, CCT has been working on landfill gas extraction and anaerobic treatment of sewage sludge and organic waste, and registering a Clean Development Mechanism (CDM) Programme of Activities for landfill gas mitigation with the UNFCCC. CCT has created the Atlantis Special Economic Zone to support the local establishment and growth of green technology companies, and undertaken a number of public transport and non-motorised transport projects that have emissions reduction co-benefits, alongside various mobility and economic benefits. These include a strategic shift toward Transit Oriented Development, promoting development along transport corridors

[23] The City of Cape Town's Electricity Savings Campaign is a social marketing campaign encouraging residents to use less electricity and informing them on how to do so (http://www.savingelectricity.org.za/).

and active implementation of the CCT Densification Policy, in order to reduce travel distances and make public transport infrastructure more viable.

6.5.4. Developing urban policy to address climate change

Building off the aforementioned activities and the growing recognition that climate change poses a significant risk to Cape Town's socio-economic success, CCT has adopted a Climate Change Policy (CCT, 2017). The policy focuses on: (1) preparing for changes in the regional and local climate by reducing risks and building adaptive capacity; and (2) contributing to national and global efforts to reduce GHG emissions while addressing energy poverty and building local energy security.

To mainstream climate change into all CCT work, the policy is designed to realise co-benefits between climate change specific goals and sustainable urban development goals more broadly, such as improved resource security, reduced costs, improved air quality, improved quality of life, long-term fiscal efficiency and the protection of lives, livelihoods, the economy, ecosystems and investments. By clarifying CCT's policy position and priorities, the policy provides a framework to encourage and enable departments within the CCT to work in more inter-sectoral and collaborative ways internally, as well working more effectively in partnership with citizens, business, NGOs and others. The policy aims to use the key levers and mechanisms held by CCT to actively drive, influence and enable change across the city as a whole. These levers include, amongst others: strategic planning; development approvals; pricing tariffs and rates; and by-law development and enforcement. CCT aims to drive change through: its own operations, infrastructure development and service delivery approaches; the way CCT internal budgets are allocated and used; raising awareness; managing natural systems and resources; the design and development of human settlements; and establishing and strengthening key partnerships with other spheres of government, academia, private sector actors and non-governmental, civil society

organisations. The co-ordination and alignment of urban climate policy with provincial and national legislation and policy is essential to furthering co-operative governance of the complex and multi-scalar set of challenges and opportunities that climate change presents.

6.5.5. Mainstreaming climate change activities

The Climate Change Policy (CCT, 2017) is a strategic effort to mainstream climate change into the operations of the local government and the wider governance network of state and non-state actors. However, a number of factors continue to inhibit the full integration climate change into all CCT line functions. A significant impediment is the financial management framework to which all line functions have to comply. Supply chain procedures limit the procurement of 'untested' technologies and application of innovative approaches, and does not adequately allow for higher upfront capital expenditure that gives rise to long-term reductions in operational expenditure (TAU and WCG, 2013). Another impediment is that concepts and terminology used in the climate change field (such as adaptation, mitigation, vulnerability and uncertainty) are often unfamiliar to specialists in other fields and political decision makers. This undermines understanding and ownership of the issue, undermining mainstreaming efforts.

In early 2015, the CCT set up transversal management structures to promote the integration of policy development, implementation and service delivery across local government (De Lille and Kesson, 2017). One of these structures is the Green Economy, Energy and Climate Change (GEECC) Working Group, comprising representatives from 14 different line functions. This is a critical forum through which to mainstream climate change issues and pursue the adoption and implementation of the Climate Change Policy (CCT, 2017). In May 2016, the CCT became a member of the 100 Resilient Cities Network[24], which

[24] www.100resilientcities.org/

will enable an interrogation of the extent to which the climate change response to date has contributed to city-wide resilience and guide any required changes moving forward. This presents another opportunity to promote mainstreaming.

6.6. Conclusion

The chapter has shown that Cape Town faces a number of inter-related development and climate change challenges. It highlights that much work is underway to reduce climate risks, build adaptive capacity and reduce GHG emissions, such that Cape Town can be viewed as somewhat of a leader in the field of urban climate policy and practice. However, climate change is not yet a mainstream development issue within the planning, decision making, design and management of Cape Town's urban system. There is growing acknowledgment that the climate impacts significantly on the socio-economic development of Cape Town and that current and future changes in the climate should therefore be factored into a variety of decisions made by local government, as well as others. This view is expressed in a number of official CCT documents but it is by no means ubiquitous amongst those working for local government. It is the diversity of views, interests and priorities held by different units and functions within local government that makes the process of adapting to climate change difficult to progress and consolidate, as will be explored in detail in the next three case study chapters.

Chapter 7: Creating climate adaptation plans of action

7.1. Introduction

Having provided the context of addressing intersecting climate and development challenges in Cape Town in the previous chapter, I now turn to investigating the specifics of the first process undertaken within Cape Town's city government explicitly aimed at adapting to a changing climate. This is the process by which Climate Adaptation Plans of Action (CAPAs) were developed for particular sectors identified as being at risk from climate impacts. Particular attention is given to the temporal and organisational aspects of the process, notably which actors were involved in the CAPA process, in what ways, the sequence of events, decisions, actions and interactions that gave rise to the plans. The chapter describes three sequential phases in climate adaptation planning driven by municipal government. Drawing on the adaptation governance and barriers literature, I critically reflect on the progress made in adapting Cape Town to changing climate conditions through the development of the CAPAs in order to surface themes and early propositions to explore further in the other case studies. The findings from this processual case study highlight the involvement in the climate adaptation process of multiple actors who hold different knowledge about, and decision making power over, the interactions between the functioning of the city and the climate. It thereby demonstrates that the implementation of urban adaptation requires the coordination of actors who hold relevant expertise, resources and mandates to identify or design, prioritise and operationalise selected interventions, as well as those tasked with oversight and evaluation of the measures being implemented in order to feedback into and adjust future choices and actions. As such, climate adaptation is not simply a technical process but a social, political and organisational one. This first case study brings to light the difficulties of monitoring and keeping track of both the process and the outcomes of urban climate adaptation processes, in part because of the number of actors involved and expertise required. This in turn undermines intentions of and efforts at evaluating progress and

making adjustments (either incremental or transformative) in light of new information and lessons learned because of the lack of suitable coordination and feedback mechanisms, a theme that surfaces again the subsequent two case studies.

7.2. Tracing the process of climate adaptation planning in Cape Town

The CCT first expressed clear intent to address climate change with the drafting of an Energy and Climate Change Strategy (CCT, 2006), initiated in 2003 and adopted in 2006, and the development of a Framework for Adaptation to Climate Change in the CCT (FAC4T) in 2006, both coordinated by officials in the CCT's ERMD. This was line of work was enabled through the CCT's involvement in the Sustainable Energy for Environment and Development (SEED) and the Urban Environmental Management (UEM) programmes, funded by the Danish Development Agency (Danida), prompted by both a concern for high levels of energy poverty in Cape Town and the increasingly degraded state of the city's coastline (interviews with ERMD staff in April, July and August 2012).

The need for an Energy and Climate Change Strategy was articulated in the CCT's Integrated Metropolitan Environmental Policy (IMEP), adopted by the City Council in 2001 (CCT, 2001). Other than listing an Energy and Climate Change Strategy as one of the mechanisms for implementing the policy, the IMEP gives no other explicit mention of climate change. The IMEP does however articulate the importance the CCT places on protecting and enhancing the quality of Cape Town's environment to provide spaces for recreation and sustaining biodiversity, eradicating "*environmental poverty*" (CCT, 2001, p. 5), and providing energy, transport, water, waste, housing and livelihood support services that are safe, clean, efficient and environmentally sustainable.

The Energy and Climate Change Strategy puts energy at the forefront of local climate change concerns, focussing attention on: the city's heavy reliance on fossil fuel based energy (notably coal-based electricity, petrol and diesel); the high levels of greenhouse emissions and other air pollutants associated with such energy consumption; and the existence of unacceptable levels of energy poverty within parts of the city. The Strategy articulates a need to dramatically shift both the supply and usage of energy, and presents targets for making such changes. The Strategy also mentions the need to assess climate impacts and develop strategic responses, but without providing any detailed goals or targets equivalent to those put forward for mitigation. It is to address this imbalance in the strategy that that the adaptation planning process is initiated by the development of an adaptation planning framework. Using the analytical tools of temporal decomposition and bracketing provided by processual case research it is possible to identify and describe three phases in the climate adaptation planning process undertaken within Cape Town's local government.

7.2.1. Phase 1: a framework for adaptation planning

The FAC4T, commissioned by the CCT (with CCT budget) and produced by consultants from UCT in 2006, lays the groundwork for addressing the adaptation gap in the Energy and Climate Change Strategy. The FAC4T provides a review of climate trends and projections for the region, identifies a broad set of climate impacts and adaptation strategies across a range of key sectors, and lays out a series of steps to create an action plan for reducing climate risks and vulnerabilities facing Cape Town.

Highlighting the risks that climate change poses to Cape Town and the wider region, the FAC4T laid out an 8-step process of climate adaptation planning to be undertaken by the CCT:

1. Assess current climate trends and future projections;
2. Undertake a vulnerability assessment;

3. Formulate a strategy;
4. Develop adaptation options;
5. Evaluate priority adaptation strategies;
6. Scope and design projects;
7. Implement;
8. Monitor and evaluate.

The local climate impacts that foreground the adaptation framework are mapped onto seven sectors within city management: water; stormwater management; biodiversity; fire management; coastal zones; livelihoods; and health (CCT, 2006). Within each of these sectors, a set of possible adaptation measures are suggested, some specific, like removing plantations, and others broad, like improving sanitation. However, rather than introducing an entirely new set of measures, FAC4T suggests building on existing city government activities that may not yet be seen as adaptation but contribute to adapting the city to its variable and changing climate, which should then be carefully monitored and evaluated as a basis for iterative modification. Mukheibir and Ziervogel (2007), as the academic consultants commissioned to develop the framework, point out that the framework they put forward was not based on an assessment of the city government's capacity to plan and implement an adaptation programme. They go on to flag a number of potential challenges and barriers to adaptation planning and implementation, relating to local climate knowledge and understanding, limitations of available assessment tools, budgetary constraints, short political cycles, uncertainties associated with future scenarios, and the absence of a legislative framework to enforce adaptive approaches and measures (Mukheibir and Ziervogel, 2007).

FAC4T recommends to the city government three major next steps in the adaptation planning process. The first is further research to reduce uncertainties associated with local climate projections. The second is conducting detailed vulnerability assessments of key areas, estimating likely timelines of various climate-related impacts. The third is the formal adoption of the adaptation planning framework by the CCT, committing to develop and implement a CAPA based on, but not limited to, the adaptation measures suggested in the report. This was the expert advice given to the CCT in late 2006. However, the FAC4T did not get much attention from politicians in the City Council or those in the City administration outside of the environment department that commissioned it (interviews with ERMD officials, consultants and CCT Councillors, April, May, July and August 2012).

7.2.2. Phase 2: developing a climate adaptation action plan

Based on the third recommendation in the FAC4T and again drawing in external capacity and expertise, ERMD hired a local consultant to draft the CAPA, in consultation with key officials in other city government departments. Effectively this involved taking the structure provided by FAC4T and working to expand the details of climate impacts, vulnerabilities and adaptation measures, drawing on a review of additional literature and eliciting additional practitioner knowledge and feedback from CCT staff in a number of relevant departments (interviews with ERMD officials, April and July 2012). For many across the city government asked to provide input, climate change remained a vague and distant threat, perceived to be largely divorced from their mandates and day-to-day operations and thereby considered an unwelcome distraction from more immediate pressures (interviews with ERMD consultants, May, July and August 2012). This meant that input and feedback was not forthcoming and proved difficult to collect. This begins to reveal the difficulties of mainstreaming the climate adaptation agenda across the organisation.

In developing the city-wide CAPA, the number of sectors and associated CCT line functions being covered expanded to nine, from the seven discussed in FAC4T, to better reflect the division of mandates within local government. A focus on fire hazards was dropped, while a focus on the sectors of transport, housing and spatial planning were added. Disaster risk management and education and communication were not included as stand-alone sectors in this first version of the CAPA but, recognised as being critical cross-cutting issues, were interwoven across each of the sectors covered in the adaptation plan (CCT, 2009a). While these sound like somewhat banal details, they reveal the unfolding organisational process of mapping climate adaptation onto the workings of city government.

One of the key contributions made during the development of the CAPA was to introduce the idea of sequencing adaptation options. The report offered a hugely expanded set of adaptation options under each of the nine sectors and split these up into four categories: first resort 'no regret' options; second resort options that require new or additional funding within the CCT; third resort options that require further research and institutional partnerships; and future measures (CCT, 2009a). Also, picking up on Mukheibir and Ziervogel's (2007) caveat that FAC4T was not based on an institutional analysis, the CAPA suggests it necessary to increase the CCT's institutional capacity to adapt to climate change by: creating a permanent position for a climate adaptation work stream co-ordinator; establishing an adaptation working group with senior representatives from across various relevant CCT line functions; developing and maintaining relationships with research institutes to stay current with the climate science; and investing in educating and communicating with staff across the CCT about climate change so that climate considerations can be integrated into all relevant work and withstand the effects of staff turn-over and competing agendas (CCT, 2009a).

The recommendations listed in the first version of the CAPA document (CAPA v1) were noted internally as lacking in specifics that linked closely enough to CCT operational practices across the relevant departments required to implement the plan. This proved a significant blow to the process that slowed progress significantly by requiring another round of consultations. The recommendations did, however, carry through and add a level of detail to those listed in FAC4T. The recommendations were for the CCT to: develop an early warning system; develop a drought plan; get more stakeholder involvement in the disaster risk management plans; get more and/or better downscaled climate information; monitor climate change impacts; review and amend adaptation measures in light of new information; revise the placement and capacity of CCT infrastructure and services; protect natural buffer zones and ecosystem services; undertake climate change education and communication amongst CCT staff and the wider public; build capacity to include climate change considerations into all relevant CCT decision-making processes; and focus on poverty alleviation to reduce the vulnerability of those worst affected by climate impacts (CCT, 2009a). Missing from CAPA v1 were any details on how such outcomes would be achieved, who would undertake the necessary activities, and with what resources, an omission that seriously constrained uptake and implementation. A final draft of CAPA v1 was concluded in mid-2009. A new consultant, this time from outside of Cape Town, was hired to follow up with the relevant departments and researchers to further develop the plan and establish connections with ongoing CCT operations that would facilitate implementation (interviews with ERMD officials and consultant, July 2012).

7.2.3. Phase 3: getting sector-based adaptation measures into departmental plans

Through 2010 and into early 2011, CCT staff in each of the relevant departments and branches were engaged on the rationale for climate adaptation planning and the content of the CAPA as relevant to their function (interview with ERMD official, July 2012). These discussions aimed at refining and prioritising a set of sector-based adaptation measures to be captured in a stand-alone plan that would be

owned and managed within each of the relevant departments and branches, and become a chapter or section in the integrated, city-wide CAPA version 2 (CAPA v2). However, the Durban-based consultants were unable to deliver on these objectives, in part due to a lack of climate adaptation experience and a lack of familiarity with the practices and internal dynamics of the Cape Town city government (interviews with ERMD official and consultant, July 2012). This draws attention to the difficulties of both the substantive and organisational aspects of adaptation planning and action. The task of completing the sector-based adaptation plans was then added to the workload of an existing ERMD staff member. More work was done with the various departments and branches to develop an adaptation plan that tied into their core mandate and existing areas of work.

In this phase of CAPA v2 development the list of sectors changed again slightly. Economic Development was dropped early on because staff losses meant there was no-one in the department to work with on it (interviews with ERMD consultant, May and July 2012). Disaster Risk Management was added as a sector with a stand-alone plan, instead of being a cross-cutting theme as was the case in the CAPA v1 (CCT, 2009a). The CCT's Disaster Risk Management Centre has a clear and strong mandate for risk reduction, including weather and climate-related risks, provided by the National Disaster Management Act (RSA, 2002), and so became an important ally to ERMD in the CAPA process.

In 2011, when the contract of the ERMD staff member driving this phase of the CAPA process came to an end, ten sector-based plans had been initiated, of which seven had been completed to the point of being signed off by the departmental Directors and presented to the relevant Portfolio Committee (consisting of City Councillors), two were near final drafts, and one was in an early draft, as shown in table 3.

Table 3: Sectors for which climate adaptation plans of action has been developed, the current status as of end 2016, and the number of adaptation measures listed in each

Sectors	Status of CAPA	Number of adaptation measures listed
Biodiversity	Still in draft	6
Catchment, Rivers and Stormwater	Signed off in 2011	12
Coastal	Signed off in 2011	6
Disaster Risk Management	Signed off in 2011	10
Economic Development	Still in early draft	-
Health	Signed off in 2011	12
Housing	Signed off in 2011	6
Planning	Signed off in 2011	3
Transport and Roads	Still in draft	7
Water and sanitation	Signed off in 2011	20
TOTAL	7 plans completed and signed off	82

A total of 82 adaptation measures are contained within the nine CAPAs that were completed or in final draft. The listed adaptation measures range from the general, e.g. ensure climate change considerations are taken into account in CCT's low-cost housing programme and land identification, to the very specific, e.g. model the flood risk associated with the interaction between freshwater flooding, storm surge and sea level rise to assess the impact on flood levels at coastal river mouths (CCT, 2011c).

Since 2011 progress has been made on implementing some measures listed in the sector-based CAPAs, although there is no clear, traceable record of this. This, despite an explicit commitment to implement and review the CAPAs in the CCT's Integrated Development Plan 2012 – 2017 (CCT, 2013a). The level of progress varies between departments, in part linked to the level of ambition and novelty reflected in the plan. Some sectoral plans mainly listed activities that were already budgeted for and/or underway, while others focussed on new, additional activities. There is no functional CAPA reporting and review mechanism in place, either via the departmental Directors in the City administration or the Council Portfolio Committees. While the need for effective monitoring and evaluation is highlighted in both the FAC4T guidance and CAPA v1 (CCT, 2009a), it was left out of CAPA v2 (CCT, 2011c). Another key challenge

encountered in developing the sector-based CAPAs was that no new budget was made available for implementing measures identified in the plans, severely constraining the priority placed on them within the departments tasked with implementation (interviews with ERMD official and consultant, July 2012).

The three sector-based CAPAs that were initiated but not signed off in 2011 remain incomplete (as of end 2016). This despite the development, implementation and review of the CAPAs being explicitly committed to in the statutory Integrated Development Plan 2012 – 2017 (CCT, 2013a) and the Environmental Agenda 2009 – 2014 (CCT, 2009b). It is interesting to note that the South African National Climate Change Response White Paper was finalised and adopted in late 2011. As such, much of the progress made by the Cape Town municipal government pre-dates a firm directive and mandate from national government to address climate change. Since the national climate change directive came into being, progress on climate adaptation has slowed within CCT, highlighting a notable disconnect between these local and national climate governance processes.

7.2.4. Furthering the climate change agenda on other fronts

The development of CAPA v1 and v2 did not take place in a vacuum. To the contrary, a number of other climate change related initiatives were being undertaken within the CCT during the same period. Picking up on the second recommendation put forward in the FAC4T (CCT, 2009a), at the same time as the CAPA development was underway, the CCT commissioned a sea-level rise study to develop localised scenarios of coastal inundation, assess the risks and economic impacts associated with such inundation, and identify adaptation measures to address these (Brundrit and Cartwright, 2012). Coinciding with a series of large winter storms causing extensive damage to stretches of Cape Town's coastline, this work drew attention from various CCT politicians and officials, as well as from the media, academics and members of the business community (interviews with ERMD officials and consultant, October and

December 2014). This attention and awareness helped somewhat in engaging key players in the CAPA deliberations.

In 2008, an Energy and Climate Change Committee of City Councillors was established, with a mandate to address issues of climate mitigation and adaptation (CCT, 2011b). However, energy efficiency and renewable energy items have dominated the committee's agenda so it has not provided an effective forum for adaptation reporting and oversight. In 2009, an Energy and Climate Change sub-committee of the CCT Executive Management Team (EMT) consisting of senior officials was also established. This EMT sub-committee has three streams of work, one of which is adaptation and climate resilience (Lewis and Jooste, 2012). However, like the political committee, their deliberations have primarily been focused on energy related issues, to the detriment of the broader adaptation agenda (interviews with ERMD consultants, July and August 2012).

The CAPA development paralleled four other decision-making processes that also entailed widespread efforts to coordinate inputs from numerous CCT departments. The CAPA process gained from and fed into the preparation and adoption of the CCT's Energy and Climate Change Plan (CCT, 2010) and a series of Multi-Hazard Disaster Risk Management Plans, as well as the CCT Spatial Development Framework (CCT, 2012a) and City Development Strategy (CCT, 2012b). Both of the longer-term, strategic-level documents, formally adopted by the City Council in 2012, contain numerous explicit references to climate change as a key consideration in the development of Cape Town.

During this time, the municipal government also sought to strengthen partnerships to provide research support to these ongoing planning and strategy processes. The CCT partnered with UCT's ACC and Sustainable Energy Africa, a local non-governmental organisation, to establish the Climate Change

Think Tank. The Cape Town Climate Change Think Tank was designed around a model of multi-stakeholder deliberations and knowledge co-production being promoted by the ACC to bridge the gap between research, policy and practice addressing urban challenges in Cape Town (Anderson et al., 2013). In addition to energy and mitigation oriented research work, the adaptation component of the Think Tank focused on issues of legal liability for climate damages and municipal mechanisms for financing climate adaptation, as well as on decision support tools for managing risks to the city's coastal zone from sea storm surges and rising sea levels (Cartwright et al., 2012a). Research done under the auspices of the Think Tank was presented to and discussed with a group of CCT officials, Councillors, NGO representatives and academics, and contributed significantly to raising the profile of the climate change issue locally.

It is worth noting that the second recommendation put forward in the FAC4T (CCT, 2006) of conducting detailed vulnerability assessments of key areas, estimating likely timelines of various climate-related impacts, has still not been achieved as of end 2016. During 2016 the city government put out a tender for a city-wide spatial assessment of climate risk and vulnerability to be commissioned. However, no contract was awarded due to internal procurement and funding complications, highlighting the organisational complexities of undertaking climate adaptation planning and the long timeframes this entails (interview with ERMD official, December 2016). As part of a strategy led by ERMD to elevate the urban climate adaptation process to the highest levels of decision making in city government and reinvigorate the CAPA process, including completing the remaining sectoral plans, prioritising between the many adaptation measures identified in the CAPAs, and developing a coordinated approach to monitoring and evaluating implementation, a Climate Change Policy (CCT, 2017) was drafted in 2016. After many rounds of internal consultations with numerous departments and committees within city government, coordinated by ERMD through the newly established Green Economy, Energy and Climate Change (GEECC) Working Group (a transversal management team comprising representatives from 14

different line functions mandated to mainstream climate change issues across local government), the draft policy went out for public participation in late 2016. The policy was formally adopted by the City Council on 27 July 2017, which may breathe new life into the stalled CAPA process and enable a stronger emphasis on implementation. The intention is that the Climate Change Policy (CCT, 2017) will guide the implementation of the new Environmental Strategy (still under review), the Economic Growth Strategy, the Social Development Strategy (CCT, undated), City Development Strategy (CCT, 2012a) and thereby each of the forthcoming 5-year Integrated Development Plans.

7.3. Emerging themes on adaptation planning and implementation in Cape Town

Reviewing the relevant CAPA documentation, together with the data collected from interviews and focus group discussions with a range of CCT staff, yields a number of key insights relating to: intra-organisational coordination; the technical and political aspects of decision making; the effects of resource constraints; and the challenge of tracking and adjusting adaptation measures.

7.3.1. Intra-organisational coordination

The CAPA plan and process has not achieved high visibility in the city government as a whole. Despite considerable investment over a number of years from within the environment department, the CCT's climate adaptation plans remain on the fringes of departmental activities and budget allocations (interviews and focus group discussions with CCT officials across seven departments, May and November 2012). Many within CCT are unclear on who is responsible for its implementation, monitoring and reporting. Consequently, the onus falls back on ERMD to push the process. As yet, there are no clear CAPA reporting and feedback channels, either vertically through the CCT administrative and political hierarchy or horizontally between departments. This reinforces the low visibility of the CAPA.

Somewhat surprisingly, considering the peripheral nature of the adaptation plan, all interviewees and focus group participants stated a preference to keep the CAPA rather than have it discontinued. One reason given is the role the CAPA has played in heightening awareness amongst CCT staff to prepare for changing climate conditions that impact their work. A second reason is that the CAPA has provided a mechanism to link up with the work of other departments that have inter-related mandates but have historically worked very separately. However, the CAPA has also brought to light conflicts between various departments based on their priorities and mandates. For example, conflicts over land use between those tasked with protecting biodiversity and those tasked with providing low cost housing (focus group discussion, November 2012). These conflicts give rise to protectionism and a tendency to avoid engaging in inter-departmental planning processes such as the CAPA.

7.3.2. Technical and political aspects of decision making

While the discussion above focuses on coordination between administrative departments, the decisions surrounding climate adaptation are not only technical but also political in nature, especially when it comes to public spending priorities. It is middle and senior level (not executive level) CCT officials that have been working to get climate change onto the CCT agenda and into departmental plans and budgets. However, despite international gestures such as signing up to the Global Cities Covenant on Climate (2010), the Durban Adaptation Charter (2011), joining the C40 Climate Leadership Group (2014) and the 50 Municipal Climate Partnerships Programme (2014), there is very little evidence that climate change features as a political priority within the City Council, which undermines progress on implementation. In the seven instances where sector-based climate adaptation plans have been presented to political committees with a request for support and oversight, none of the portfolio committees have subsequently requested progress reports. In the three instances where the plans have

not yet been completed, there has been no pressure from the political committees to have them presented. This despite the existence of the aforementioned City Development Strategy and Integrated Development Plan and the establishment of both the Energy and Climate Change Committee (political) and Sub-Committee of the Executive Management Team (administrative), designated to progress issues of climate adaptation and mitigation.

The lack of certainty and accuracy in climate change projections and the distant time horizons are often used as reasons for delaying investments in climate adaptation when weighed against more immediate pressing concerns, such as crime, poor public transport and waste management (interviews with CCT Councillors, April and May 2012). This is particularly true in highly unequal cities like Cape Town where, for example, it is politically difficult to justify investments in retrofitting existing stormwater infrastructure in well-serviced areas to increase drainage capacity in light of climate projections when large parts of the city remain under serviced and suffer regular flooding (focus group with CCT officials, November 2012).

7.3.3. Resource constraints

The lack of budget to undertake new climate adaptation activities and upgrade infrastructure specifications in light of changing climate risks is a real constraint in Cape Town. Because the adaptation planning process, in the form of the CAPA, did not have any new budget secured for implementation, it has not been prioritised within the departmental structures. The CCT financial management system, designed to strictly adhere to a conservative interpretation of the Municipal Financial Management Act (RSA, 2003b) to ensure clean financial audits, makes it very difficult to reallocate budget between departments without a high-level directive that is not forthcoming in light of climate concerns. The budget problem extends beyond the municipal government to the allocation of subsidies made by national

government. A clear example of this is the national housing subsidy, allocated to municipalities to deliver low-cost housing, which does not yet adequately account for thermal efficiency requirements related to ceiling insulation and fenestrations, which become increasingly critical in light of rising temperatures and stronger winds (interview with CCT official, November 2013).

Many commented on the need for more research to underpin adaptation planning, for example on the linkages between changing temperature patterns, local air quality and respiratory diseases, and the impact of increasing temperatures on transport infrastructure and water quality (focus group discussions, November 2012). But a lack of budget to contract researchers, difficulties in accessing and releasing data, and in finding people with matching research interests and expertise, all constrain the production of such research. The aforementioned Climate Change Think Tank was established in response to these needs and resource constraints. The research commissioned and events convened under the auspices of the Think Tank contributed to increasing knowledge on the local dimensions of climate change. However, levels of participation and debate were often less than hoped for by the organisers (Cartwright et al., 2012b).

The three phases of climate adaptation planning in Cape Town revealed a large gap between the science of climate change adaptation and the practice thereof. The outputs produced by academics and consultants have taken considerable translation to get from research-based prescriptions of best practice to actionable plans fitted to the structures and practices of municipal government. The loss of senior CCT staff with considerable experience and expertise is also deemed an important factor undermining action on climate adaptation, particularly mentioned in the sectors of healthcare and water management (focus group discussions, November 2012). Considerable institutional memory is lost with the departure of

senior staff, which sets complex, long-running and contested planning and strategy processes back considerably.

7.3.4. Challenge of tracking and evaluating climate adaptation

One area where the FAC4T (CCT, 2006) and early CAPA work clearly indicated a need is that of adaptation monitoring and evaluation. The need to monitor climate risks and vulnerabilities, track the implementation of adaptation measures and assess their outcomes was included in the FAC4T adaptation planning framework, but no guidance was provided on how to do it. This need to monitor and evaluate carried through CAPA v1 (CCT, 2009a), but those involved in CAPA v2 were unable to find a way of making it operational within and between the various CCT departments (interviews with ERMD consultants, May and July 2012).

The adaptation monitoring and evaluation challenge emerges on at least three fronts. The first is knowing what exactly to measure, especially because many of the adaptation actions listed in the CAPA are not specific enough to be measured. CCT officials raised the point that it is not necessarily desirable to only include items in the CAPA that are measurable because then the scope and ambition of the plan is often dramatically constrained (focus group discussion, November 2012). The second challenge relates to resource constraints. CCT departments have very limited budget for measurement, monitoring and purchasing data collected and managed by others (e.g. the South African Weather Service). They are therefore heavily reliant on partnerships with research organisations that can leverage external funding (focus group discussions, May and November 2012). However, these data collection and analysis exercises are often patchy and once-off. The third challenge pertains to evaluation. CCT officials report having very limited time between other pressing demands to analyse collected data, as well as often lacking the methods and tools for such analysis. In addition, there is a disincentive to report failures because this risks

budget cuts (interviews with CCT officials, August and November 2012). Rather, there is a tendency to inflate successes, masking the inherent challenges of adaptation and limiting opportunities for learning. The lack of monitoring links closely with the lack of a reporting mechanism and budget allocations mentioned above, relegating the CAPA to a position of low visibility and low priority within the CCT organisation.

One of the benefits of the focus group discussions in this study, noted by participating CCT officials, was the opportunity to hear about the adaptation plans of other departments, both in terms of the content of the plan and the planning and implementation process (focus group discussions in May and November 2012). It provided an opportunity to compare experiences of what is proving difficult (e.g. loss of senior staff) and what was working well (e.g. getting climate risks listed in the CAPAs added to the CCT's specialist risk registers). This highlighted the lack of such opportunities within the formal meeting schedules of the city government.

7.4. Relating the empirical findings to the adaptation governance and barriers literature

Revisiting the potential challenges and barriers to urban climate adaptation raised by Mukheibir and Ziervogel (2007), finds that the evidence gathered through this case study confirms what they cautioned against. The findings show that indeed budgetary constraints, political short-termism, uncertainties associated with future scenarios and the absence of a legislative framework to enforce adaptive measures have all contributed to limiting progress on adaptation in Cape Town. The findings highlight that even with advanced warning of the challenges or barriers they are extremely difficult to avoid or overcome.

Ziervogel and Parnell (2012) identify an additional barrier, that of ambiguity in who holds what roles and responsibilities when it comes to climate adaptation, both within local government and between the different spheres or levels of government. This ambiguity, together with the 'silo approach' that government structures perpetuate, they argue, undermines coordination and collaboration and thereby the efficacy with which holistic and robust responses to addressing climate risks and vulnerabilities can be implemented (Ziervogel and Parnell, 2012, p. 237). The evidence collected in this case study strongly supports this proposition. However, what Ziervogel and Parnell (2012) do not point specifically to, which has emerged in this case study, is the issue of tracking adaptation progress, of monitoring and evaluating the implementation and outcomes of climate adaptation measures, as a critical mechanism for coordinating action and learning that is largely missing in the CCT case and thereby undermining progress with implementation.

Winsvold et al. (2009) characterise three typical modes of governance that present different ways to coordinate the learning and action required for climate adaptation. It is possible to view the Cape Town city government as a hierarchical set of actors (i.e. branches, departments, directorates and committees). Doing so reveals that the case study supports Winsvold et al.'s (2009) claim that one of the weaknesses of the hierarchical mode of governance, characterised by top-down coordination from a central authority, is the poor feedback of knowledge pertaining to the problem (local climate impacts) and the implementation of solutions (prioritised adaptation measures) from subordinate units to the central authority. However, the case study challenges Winsvold et al.'s (2009) proposition that one of the strengths of the hierarchical mode of governance is ensuring widespread implementation of an extensive range of adaptation-related activities through coercive enforcement from a central authority. While this may be theoretically true, it has not proved the case in Cape Town because the climate adaptation planning process has not been introduced or prioritised by a central authority, whether the Mayoral

Committee, the Energy and Climate Change Committee or the Executive Management Committee within the CCT. Rather it has been initiated by the CCT environment department, a subordinate unit within the City administration. This has made it difficult to mainstream climate adaptation into the work of other departments and has hampered implementation. This supports similar findings made by Measham et al. (2011) and Anguelovski et al. (2014), suggesting that sustained political leadership is needed for adaptation planning to gain traction across the operations of local government. However, Uittenbroek et al. (2013), based on experience in Dutch cities, caution that even the appearance of successful mainstreaming into existing policy domains such as urban planning does not ensure the implementation of adaptation measures.

Establishing the Climate Change Think Tank to link various CCT actors up with local researchers, commission new research, and serve as a forum for reporting, review and advice (Cartwright et al., 2012a) has been one attempt at addressing the institutional constraints of mainstreaming adaptation from below in a hierarchical government organisation. It constitutes a shift between the hierarchical mode that the city government operates in to the network governance mode, which supports Winsvold et al.'s (2009) ultimate argument that a well-developed ability to shift between governance modes to leverage the strengths and limit the weaknesses of each mode to coordinate learning and action is necessary for effective adaptation.

7.5. Conclusion

By spending time over three years working with those directly involved to investigate and document the process by which CAPAs were developed within Cape Town's city government, it becomes apparent that the CCT has made considerable progress in undertaking the first two stages in the policy

and planning cycle, those referred to as agenda-setting and formulation by Clar et al. (2013) or understanding and planning by Ekstrom and Moser (2013) and Uittenbroek et al. (2013). Multiple new policies and plans adopted by the City Council include the aim of reducing climate risks and impacts. However, when it comes to the implementation, the monitoring and the evaluation of new policies and plans, the process has stalled on numerous fronts. This seems, in part, to be explained by the hierarchical nature of the governance mode in which the city government operates and the fact that early attempts at climate adaptation have come from the lower levels of the hierarchy, rather than the central, powerful apex made up of the senior officials (notably Executive Directors) and City Councillors, most notably the Executive Mayor and members of the Mayoral Committee.

This first case study confirms that there is value in looking more closely and carefully at decision making processes within local government, disaggregating local government into numerous actors operating collectively, but not always in a coordinated and collaborative manner, to better understand and conceptualise how urban climate adaptation processes unfold. This case study also reveals that having an adaptation plan is a necessary but insufficient marker of progress on lowering climate risks, vulnerabilities and impacts in a city. One needs to look much more closely and critically not only at what is proposed within the climate change plan, but also how it has come about and who is taking ownership of the process to implement and enforce the measures contained within it. Three propositions emerging from this case study to be investigated further are that:

1. urban adaptation requires both technical and political processes of decision making, which often conflict;
2. the multi-sectoral nature of urban climate adaptation makes coordination difficult yet essential in order to prioritise and sequence adaptation measures, evaluating outcomes and adjust accordingly;

3. city governments rely on external expertise to undertake adaptation planning but the external nature of what is produced inhibits the internal traction required for implementation.

To investigate these propositions further, the next chapter examines the process by which a City Development Strategy (CDS) was drafted and adopted by the CCT, in consultation with various stakeholders. Particular attention is paid to how climate problems and potential solutions or interventions feature in the strategy and the ways in which these emerged. The CDS process constitutes a valuable case study for understanding urban climate adaptation as a process of decision making because it marks an attempt to mainstream climate adaptation thinking and priorities into a high-level CCT strategic planning framework that integrates across sectors.

Chapter 8: Climate change in strategic planning

8.1. Introduction

The previous chapter presented the process by which Cape Town's city government addressed climate adaptation as a primary goal by developing a set of sector-based plans to identify relevant climate adaptation measures and get commitment from respective administrative departments and political oversight bodies to implement the adaptation measures that fall within their respective mandates and budgets.

This chapter aims to explore the role of strategic planning as a vehicle for furthering the urban climate adaptation agenda and coordinating efforts at adapting to climate change across the city government as a whole. In order to investigate the use of strategic urban planning in climate change adaptation, this chapter first looks at what strategic urban planning is and why it has been promoted internationally and in South Africa, giving particular attention to the City Development Strategy (CDS) approach promoted by the Cities Alliance, which was used in Cape Town. Secondly, the chapter looks to the climate adaptation literature for arguments on why a strategic planning approach is needed to adapt to climate change at the city scale. Thirdly, the chapter investigates what Cape Town's CDS (CTCDS) says about adapting to climate change, how that articulation came to pass, and what position the CTCDS holds in the broader decision-making landscape. Finally, the chapter surfaces findings from the Cape Town case that talk to the larger debate about strategic planning as a vehicle for urban climate adaptation.

8.2. The rise of strategic urban planning internationally

Within the fields of urban policy and urban scholarship much emphasis is placed on projecting, articulating and critiquing city futures, visions of the desired or undesired (i.e. utopian or dystopian) city in twenty to fifty years' time (Pieterse, 2008; Robinson, 2008; Watson, 2014; Friend et al., 2016). This is partly done as a basis for identifying and prioritising interventions and investments necessary for achieving or avoiding such urban futures. The notion of strategic planning of cities emerged within the public sector in the 1980s in the United States of America and Europe. Having gained traction in the private sector in the preceding decades, a number of academics and consultants began promoting the idea of strategic planning within all levels of government, especially in light of volatile economic conditions and demographic shifts taking place at the time in the Global North (Bryson and Roering, 1987; Albrechts, 2001). Strategic planning is designed to guide decisions and their implementation across all the functions and levels of an organisation by creating a rational framework within which resources are allocated and controlled (Bryson and Roering, 1987). While the private sector used strategic planning within the confines of a single company or organisation, the use of strategic planning in cities was expanded with the hope of guiding not only the decisions across all functions and levels of city government but also sought to shape the mission, priorities and practices of other organisations operating in and shaping the city. Barcelona is credited as having one of the first city-wide strategic plans, initiated in 1988 largely to prepare for hosting the 1992 Olympic Games (Marshall, 2000).

The adoption of strategic planning by city governments marked the rise of neoliberalism and managerialism (Parnell and Robinson, 2006; Robinson, 2008). Within this paradigm, cities are seen as competing with other cities in the global economy and the private sector is considered more efficient and cost effective than government at providing many public goods and services, such as water provision and waste collection, leading to the promotion of privatisation and corporatisation of government agencies.

As such, management tools and practices that identify and build on the relative strengths of a city and its constituent organisations, capitalising on national and international opportunities, and guarding against perceived threats and existing weaknesses, are seen as valuable, if not critical (Bryson and Roering, 1987). As Smit (2015) points out, the promotion and adoption of strategic planning in cities globally responds to three major shifts: (1) from government to governance, i.e. linking policy domains across multiple levels and redistributing responsibilities for service delivery and economic development between the public, private and civil society sectors (often referred to as the rolling back of the state); (2) increasing fiscal austerity (particularly in Europe and North America); and (3) increasing competition amongst cities within a globalised economy to attract investment, business and visitors.

Strategic planning has largely superseded the practice of master planning. Master planning aims at producing comprehensive technical spatial plans detailing the intended design, layout and infrastructure provisioning for each area in a city. By contrast, strategic planning takes a more political and economic view on city development and aims at intervening in more selective and targeted ways, prioritising 'catalytic' activities and places in order to (re)shape the city towards a preferred vision (Albrechts, 2001). Strategic planning gives greater attention to the external environment and forces beyond the spatial boundaries of the city, as compared with the place-based focus of master planning. Additionally, strategic planning tends to involve a variety of actors in the planning process, spanning the public, private and civil society sectors, whereas master planning tends to be undertaken by planners and engineers in local governments and their preferred consultants or service providers (Smit, 2015).

Large policy and financing actors operating internationally in the urban space, notably UN-Habitat, the World Bank and the Cities Alliance, have been strongly promoting the use of strategic planning in cities globally. The notion of creating a long-term city vision as a basis for guiding short- to

medium-term decision making has been an area of policy development strongly promoted by the Cities Alliance since the late 1990s through the creation of CDSs, as one particular approach or methodology for strategic urban planning. A CDS is "*an action-oriented process, developed and sustained through participation, to promote equitable growth in cities and their surrounding regions to improve the quality of life for all citizens... considering where [cities] should be in 20 or 30 years, and the steps that need to be taken to achieve those goals*" (Cities Alliance webpage, 2015). Many cities internationally have invested (often with additional international donor funding and technical support) in convening representatives from multiple urban constituencies to deliberate over possible city futures, coming up with a vision statement and setting goals for transitioning towards that vision (Cities Alliance website, undated).

8.3. The rise of strategic urban planning in South Africa

In South Africa, strategic planning in cities emerged in the late 1990s and early 2000s as part of the transformation of local government from the Apartheid to post-Apartheid systems of government. With newly demarcated boundaries, a new Constitutional mandate, and a policy imperative for integration, reconstruction, redistribution and development, local governments across South Africa were tasked with massively expanding and improving public service provision, especially to areas excluded by the Apartheid government, and grow the local economy to create employment and expand the tax base (Pillay, 2008). In urban areas, numerous local government entities were amalgamated into single city governments (what became local governments of Category A metropolitan municipalities in South African legal parlance) with the aim of overcoming segregation, fragmentation and huge inequalities that had been established under Apartheid. For the challenging task of planning the spatial, economic and social development, integration and the (re)allocation of resources at the municipal scale, local governments were given the strategic planning tool of an Integrated Development Plan (IDP).

The idea and tools of integrated development planning came from national government through two sources. The first was the work of the Reconstruction and Development Programme (RDP) Office, set up in the Office of the President to nationally coordinate the implementation of the government's redistributive socio-economic development policy. The second source was that of the inter-departmental Forum for Effective Planning and Development (FEPD), which was tasked with investigating development planning methods and tools, drawing on international experiences (Binns and Nel, 2002; Harrison, 2006).

Introduced through the Local Government Transition Act Second Amendment Act (No. 89 of 1995) (RSA, 1995), the formulation of IDPs became a legal requirement for all South African local governments in November 1996. Further IDP specifications were provided in the Municipal Systems Act (No. 32 of 2000) (RSA, 2000a). Aligning with electoral cycles, IDPs operate on a 5-year time-frame, with annual reviews, and aim to bring together economic, social and environmental objectives, link development agendas across all spheres and departments of government, and facilitate the participation of stakeholders from the business sector and civil society in the identification of priorities within the municipality (Pieterse, 2007).

While the aims of the IDP process closely align with the ideas of strategic planning, the practice of preparing and implementing IDPs by local governments across South Africa has fallen far short of these ideals. Constrained by funding streams, the rise of conservatism fuelled by performance management, time pressures on delivery and low public participation, IDPs have mostly tended to replicate fragmented sectoral priorities and insufficiently address issues of sustainability (Harrison, 2006; Sowman and Brown, 2007; Pieterse, 2007; Frödin, 2009; Smit, 2015). However, as Smit (2015) notes, IDPs have contributed significantly to increasing resource allocation to poorer parts of the city and creating networks, both within local government and with some stakeholders external to government.

Because of limitations in the IDP process, particularly short-termism driven by electoral cycles and low levels of participation by those outside of local government, metropolitan municipalities have in the last decade begun to develop CDSs, in addition to their statutory IDPs, as a way of taking a longer-term, strategic view to planning the development of cities, taking into account a variety of public, private sector and civil society perspectives and priorities. The use of a CDS planning process was strongly promoted through the South African Cities Network (SACN). Set up in 2002, with funding from the Cities Alliance, the SACN was designed to be a forum for knowledge sharing between South Africa's nine metropolitan municipalities and developing the urban agenda in South Africa (Smit et al., 2008). The Cities Alliance had supported the City of Johannesburg in developing a CDS, known as the iGoli 2010 process, which led to the Joburg 2030 strategy published in 2002 (Parnell and Robinson, 2006). Durban initiated a visioning and long-term planning process around a similar time that led to the eThekwini Municipality's Long Term Development Framework, adopted in 2003 (Robinson, 2008).

Robinson (2008) comments on how the rise of strategic urban planning marks a shift in urban poverty and development interventions from the microscale of locations (i.e. site specific slum upgrading projects) to policy interventions aimed at the city-wide scale, based on a recognition that the need is to connect people to jobs and services wherever they are located. Doing so requires a focus on the wider institutional landscape, especially city government. Scholars investigating these long-term strategic urban planning processes and the resulting strategies have commented on the delicate and often awkward balancing act undertaken in these exercises between pushing economic growth imperatives and basic service delivery imperatives, particularly in cities of the Global South where high levels of unemployment persist and many city residents live in hazardous, often informal, conditions of settlement (Parnell and Robinson, 2006; Robinson, 2008; Smit, 2015). A third policy agenda that also underpins the logic of these long-term strategic urban planning processes is that of sustainability, which pushes the balancing act into

even more awkward territory. Tackling climate change at the city scale is currently being added to that sustainability imperative within the design and development of City Development Strategies (UN-Habitat, 2015), as will be explored further in this chapter in the case of Cape Town.

8.4. Climate adaptation and strategic planning

With cities now home to more than 50% of the global population and producing 70% of GDP internationally, it is increasingly recognised that cities are key sites for addressing climate change, both by reducing the emission of greenhouses gases and by adapting the structure and functioning of cities to reduce the damaging impacts of climate change (Hallegatte and Corfee-Morlot, 2010; UN Habitat, 2011). Adapting to climate change at the city scale means guiding or governing adaptation across both the spatial extent of the city and the full range of climate risks and vulnerabilities that require adaptation. As such, for climate change adaptation to be undertaken at a city scale requires planning and coordination in order to take decisions on what should be done, where, how, when, by whom, with what resources, and to have the oversight needed to track progress, assess impact and value and make adjustments or transformations as needed, not only at the project level but also at the aggregate city scale (Lundqvist, 2015; Boyd and Juhola, 2015; Huitema et al, 2016; Mees, 2016).

On the one hand, the problem of climate change (both the drivers and impacts of climate change) is so much bigger than the activities of any one actor and even any one type of actor (i.e. a sector or industry). Ultimately the activities and investments of individuals, households and organisations have to be aggregated and coordinated to make a significant contribution to reducing the problem of negative climate change impacts. On the other hand, the intersection between climate change and urbanisation is spatially varied. In other words, the risks and impacts created by the climate are not homogeneous across

a city but rather are experienced at different times and to different degrees in locations across the city. For example, coastal flooding exacerbated by sea level rise will hit certain stretches of coastline, extend a certain distance inland and create a certain amount of damage based on a number of local factors such as the morphology of the coast, the type and design of infrastructure along the coast, the maintenance of that infrastructure, the numbers of people that live in the area, their capacity to protect themselves from flooding, the functioning of ecosystems along the coast and their ability to absorb flood waters (Brundrit and Cartwright, 2012). As such adaptation measures need to be planned on the basis of spatial variation. Spatial planning instruments are thereby increasingly recognised as critical to the identification of climate adaptation needs, the selection of suitable adaptation options and the enforcement of adaptation measures in locales that on aggregate make the city more resilient to fluctuations and trends in the climate.

Davoudi et al. (2009), Wilson and Piper (2010), Hurlimann and March (2012), Parnell (2015) and Carter et al. (2015) all argue that planners are key to the urban adaptation effort because their discipline and practice is future oriented, cross-sectoral, multi-scalar and participatory in nature. In addition, planners have a track record in managing flood risk, which can be further built on to address other climate change risks and vulnerabilities. As Carter et al. (2015, p.50) put it: "*The current generation have an urban inheritance that, in some respects, is sub-optimal in the face of the changing climate; drainage systems are sometimes overwhelmed by extreme rainfall and buildings are located in floodplains. Given our awareness and knowledge of climate change, it is now inappropriate to pass on buildings, infrastructure and landscapes that are poorly adapted, and planning has a key role to play in guarding against this.*"

Davoudi et al. (2009, p.14) define planning as "*the processes through which options for the development of places are envisioned, assessed, negotiated, agreed and expressed in policy, regulatory*

and investment terms", thereby encompassing strategic decisions regarding urban growth and land use as well as site specific development controls entailing decisions at the land parcel or property scale. Wilson and Piper (2010, p.10) expand this to "*the ability to plan, in a democratically accountable way, the activities of economic and service sectors (such as housing, energy, economic development, transport, water, waste social welfare and health) that have spatial or land-use consequences in their wider social and environmental context*." They go on to note that "*planning requires the integration and coordination of both the drivers and the outcomes of these policy sectors, and the integration of demand management in influencing societal choices*." (Wilson and Piper, 2010, p.10). As Carter et al. (2015) note, spatial and land use planning is a key field for tackling climate change in cities because it is a domain that draws in and effects many actors shaping the city space, it deals with numerous types of critical infrastructures (e.g. water, transport, waste, energy, coastal protection and property development), and it is inherently forward looking. The challenge is that it is also inherently political in nature, as land and space has contested value and competing uses. So it comes back to the recurring question surfacing in this dissertation study of how scientific, technical, administrative and political structures and processes are brought together to progressively and adaptively shape city development trajectories, either incrementally or in a transformative manner.

While the discipline of planning offers a number of tools potentially applicable and suitable to the task of adapting locations to changing climate conditions, that of strategic planning is particularly relevant to the city scale for a number of reasons. First, strategic planning provides a framework in which to deal with the diversity of climate hazards and varying levels of climate sensitivity that exist within a city. Secondly, strategic planning encourages decision makers to consider and account for climate risks that manifest outside of the boundaries of the city but have impacts on the city (for example drought in areas where water, food and/or hydro-power is sourced for the city). Thirdly, strategic planning takes a longer-

term view on the future, thereby bringing into clearer view the larger extent of changes in the climate and associated impacts projected for the coming decades than is evident in the historical record or the near-term projections. In other words, the unprecedented scale of the climate change problem and thereby the relative importance it might be afforded in policy terms only becomes fully evident when taking a longer term view than is traditionally associated with planning practices, which tend to be caught up in experiences of the past and the immediacy of current day political and economic pressures on decision making. Fourth and finally, strategic planning explicitly positions climate change adaptation and mitigation as two of multiple policy priorities, including economic growth, international competitiveness, job creation and housing provision, thereby confronting questions of inter-linkages, potential synergies and possible trade-offs.

Despite this potential, already evidence is surfacing in the literature about the limitations and constraints of planning as a vehicle for city-wide climate adaptation. Based on experience in Greater Manchester, Carter et al. (2015) point out that planners within local authorities are constrained in the extent to which they can coordinate urban climate adaptation due to the following factors: boundaries and different ways of operating between sectors that are difficult to span; limited expertise in dealing with climate data and information; institutional norms, processes and regulations that are difficult to change; and limited or variable access to the resources (financial, human and technical) needed to do work on complex and multi-dimensional problems such as climate change. In the case of Manchester in the UK, which is the focus on Carter et al.'s (2015) study, these limitations were tackled through the formation of the Greater Manchester Combined Authority in 2011 to formalise strategic collaboration between the ten local authorities that make up the Greater Manchester conurbation, especially on issues relating to economic development, urban regeneration and transport. A private sector led Greater Manchester Local Enterprise Partnership was set up at the same time and together these new city-

regional organisations oversee the implementation of the Greater Manchester Strategy, a framework for stimulating economic grow and increasing prosperity across city-region. While the Greater Manchester Strategy highlights the importance of adapting to climate change as part of the pursuit for economic prosperity, which is further developed in a Greater Manchester Climate Change Strategy, Carter et al. (2015, p.10) note that "*the challenge is now to move beyond city-region scale high level policy and guidance frameworks... to embed adaptation responses across the activities of organisations such as local planning authorities*". Reflecting back on the case of developing the CAPAs in Cape Town, presented in the previous chapter, it is becoming apparent that there is a tension and set of trade-off between embedding the urban climate adaptation agenda at the operational level of line functions and sectoral departments and then integrating up to the strategic level (as is being attempted in the case of Cape Town), and first making it a strategic priority and then dividing up responsibilities between different organisations and government units (as seems to be the case in Manchester for example). These tensions might only be a function of hierarchical governance arrangements and may not feature in networked governance arrangements: a question for future research.

City-wide planning is primarily the domain of the public sector (with the assistance of their private sector service providers). In theory, strategic planning provides government and its stakeholders and development partners with tools to (re)orient and (re)organise land use, public sector spending and possibly sway private sector investment to some extent, and thereby shape the distribution of activities and investments across the city for various purposes. Strategic goals may include increasing economic efficiency and competitiveness, social equality and environmental sustainability, as well as climate adaptation and resilience. However, strategic planning is only as effective as government is influential in the use of land and the direction of investments and activities and has convening power over other influential city actors in the private and civil society spheres. This cannot be assumed, especially in cities

of the Global South where levels of informality are high and the resourcing and capacity of government, especially local government, is low. As Parnell (2015) argues, planning in the context of African cities is a discipline and a profession plagued by a poor reputation, limited legitimacy and severe capacity constraints. Despite this, planning cannot be bypassed if climate change is to be systematically addressed in cities. To explore this further, I now turn to the case of strategic planning in Cape Town to investigate what it reveals about the potential value and limitations of strategic planning for furthering climate adaptation at the city scale, as led by local government.

8.5. Preparing Cape Town's City Development Strategy

The Cape Town City Council formally adopted a City Development Strategy in October 2012, but it had been a long time in the making. The idea of developing a CDS surfaced in Cape Town roughly ten years earlier, with the formation of the South African Cities Network (SACN), launched in 2002 (interview with EDP official, July 2015). The SACN brought the metropolitan municipalities into a learning network to support planning and assess progress towards common developmental goals. The two main planning methodologies or tools proposed within the network were (1) that of a City Development Strategy, as a means of convening multiple stakeholders to envision a desirable long-term future for the city and identify priority interventions for achieving such a future, and (2) State of Cities reporting, as a means of monitoring and assessment purposes (interview with EDP official, July 2015). Drawing on international guidelines and experiences from cities in other developing countries, the SACN adapted the CDS methodology for the South African context and encouraged the newly established metropolitan municipal governments to initiate CDS processes (Smit, 2015).

Work on the CDS began in earnest in Cape Town in 2008, after strong lobbying from within the CCT's Spatial Planning and Urban Design (SPUD) department (interview with CCT officials, April 2013). With Johannesburg and Durban already having developed a CDS, Cape Town's local government felt under some pressure to produce one, in part to meet a local need for longer-term, future-oriented strategic planning, but also partly to avoid being left behind other South African metropolitan municipalities. Another impetus for, and informant to, the CTCDS was the completion in 2008 of a territorial review study by the Organisation for Economic Co-operation and Development (OECD) that focused on the Cape Town functional region (OECD, 2008). The OECD study found that, having undergone an intensive democratic transition, the city-region's economy has many strengths and considerable potential for growth, but that persistent social and spatial fragmentation and inequality severely undermined such potential (OECD, 2008). It suggested that while many agree on the nature of the problems facing the city-region, there was much debate and contestation over the most effective means to addressing these problems. As such the report suggested that a shared vision needed to be developed amongst the main stakeholders in order to foster the inclusive and sustainable economic development needed to improve local conditions and compete internationally. These multiple drivers to produce a CDS culminated in the drafting of a paper outlining a CDS framework for Cape Town, produced in 2009 by SPUD. The task of coordinating the preparation of a full CDS was allocated to the Strategic Information Branch (SIB) of the Strategic Development Information and GIS Department in the CCT's Corporate Services Directorate (interview with CCT officials, May 2012). In 2010 external service providers were contracted to drive the CDS development, including widespread stakeholder engagement regarding the 2040 vision for Cape Town and harvesting ideas for how to move towards such an envisioned city (CCT internal planning document, April 2011; interviews with CCT officials, April 2013).

The process of developing a CDS for Cape Town coincided with a similar process initiated by the provincial government to develop a Future Cape vision and development strategy for the Western Cape region as a whole (interview with CCT officials, May 2012). Because Cape Town's economy accounts for approximately 73% of the Western Cape's GDP (Western Cape Government Provincial Treasury, 2015), any long-term regional development strategy had to include the city. So the Future Cape and the Cape Town CDS processes were, in early 2012, brought together under the auspices of the newly formed Economic Development Partnership (EDP), into what became OneCape 2040 (CCT, 2012a; interview with EDP official, July 2015). The EDP had been formed with a mandate to get the CCT and Provincial governments more aligned and able to work more effectively together. So the EDP ran a process to bring together the CCT's work on the CDS and the work done by members of the Provincial Government on the Future Cape strategy and created the OneCape 2040 framework document, articulating six transitions to be navigated, transitions in: knowledge; economic access; ecology; culture; settlement; and institutions (interview with EDP official, July 2015; CCT, 2012b). However, because the CDS process was already so far advanced, the CDS did not cease to exist by getting entirely integrated into the OneCape 2040. Rather, various elements of the CDS were aligned with the OneCape 2040 strategy, notably the vision statement, the goals with the transitions, and the timelines for completion, and then both the CDS and the OneCape 2040 documents were presented to Council in October 2012. In effect, the CDS became an internal strategy within the local government organisation, instead of the broader multi-stakeholder shared strategy that had originally been envisaged (interview with CCT officials, April 2013).

In the final stages of drafting the CDS, the Strategic Policy Unit (SPU) was established in the Mayor's Office. The SPU was set up to coordinate and streamline policy and strategy development and implementation across the CCT, primarily through setting performance management targets for senior officials and politicians, reviewing departmental plans for alignment, and creating a transversal

management system to foster more collaboration and coordination between line functions, directorates and departments (interview with CCT official, July 2015)[25]. In this role, the SPU took over custodianship of the CTCDS from the Strategic Information Branch that had facilitated its development. This change of custodianship led to the repositioning of the CTCDS within the CCT's organisational structure, coupling it with new organisational processes and priorities, which created both opportunities and limitations, to be further discussed later in the chapter.

8.6. Reading Cape Town's City Development Strategy through a climate adaptation lens

With some sense of how the CTCDS came to be, over a number of years and various interconnecting processes, I now turn attention to the final CTCDS document adopted by the Council in October 2012 (CCT, 2012a) to look at how climate change features or finds expression within this strategy. Climate change features with some prominence in the CTCDS, appearing as a systemic issue woven into the description of the both the large-scale challenges facing the city and the wider city region and the goals to be met in reaching the 2040 vision put forward for Cape Town (CCT, 2012b). Within the CTCDS, climate change is primarily related to concerns of food, energy and water security in the city, but surprisingly not health or physical safety despite considerable local interactions between climate and health, as well as an expansive history of climate-related disasters. Emphasis is placed on increasing the resource efficiency of the city over the medium to long-term and the need for research and innovation to support such a transition. This need for research and innovation is in turn presented as an economic opportunity for Cape Town, with the CTCDS proposing Cape Town as a place to develop, pilot and test new approaches and technologies that generate climate resilience and low carbon growth that, once proved to be effective, can be exported across the continent. The CTCDS highlights Cape Town's remaining

[25] For a rich and detailed account of the establishment, mandate and operations of the SPU, including the reorientation of the CTCDS, read De Lille and Kesson (2017).

natural resources as a key strength and source of adaptive capacity in the face of climate change, thereby motivating to protect and restore these natural assets through labour-intensive public works programmes and by limiting and directing urban expansion. The CTCDS progressively promotes both climate change mitigation and adaptation as important strategic directions to be pursued in Cape Town.

It is somewhat surprising that issues of social equity and justice as pertaining to climate change are not explicitly raised in the CTCDS, despite high levels of inequality being a key feature of Cape Town and South African society at large. The team drafting the CTCDS apparently worked hard at expanding the definition of resilience, a notion and goal which is given prominence in the strategy, from one of ecological resilience to one of social resilience (interviews with CCT officials, May 2012 and April 2013). However, when the CTCDS was being aligned with the Provincial OneCape 2040 framework, a heavier focus on economic growth and development was brought to bear on the vision and goals, diluting the emphasis on the social and environmental dimensions of the vision as previously formulated in the CTCDS draft and stakeholder consultation process (interviews with CCT officials, May 2012). This is evident in the CTCDS draft vision statement, which was: "*In 2040 Cape Town is one of the world's greatest cities in which to live & learn, work, invest & discover. Cape Town is a place of possibility and innovation, with a diverse urban community and all the opportunities and amenities of city life, shared within a natural environment that supports economic vibrancy and inspires a sense of belonging in all.*" (CCT, 2011d, p.16). But, in order to align with the provincial strategy, the vision in the final CTCDS adopted by Council was changed to: "*A highly-skilled, innovation-driven, resource-efficient, connected, high opportunity and collaborative society.*" (CCT, 2012b, p.30).

When read through a climate change lens, each of the 6 goals put forward in the CTCDS can be seen as having climate change linkages. Goal 1 - a healthy and vibrant life - requires keeping risk to an

acceptable and manageable level, including climate risks that compromise health and safety of city residents, such as heat spells, dry spells, droughts, heavy rains and flooding. Goal 2 - being educated and informed - involves a better understanding, by residents and organisations across sectors, of the nature of climate change in terms of its drivers, risks, impacts and how to address them in a Cape Town context. Goal 3 - being connected - in addition to being socially, economically and physically connected, could include being more connected with the ecosystems and climate system that we rely on for water, food, clean air, energy and recreational spaces. Goal 4 - an inclusive and resilient economy - requires infrastructure and activities that are well adapted to both the prevailing and expected climate conditions to minimise flood, fire and wind damages, limit the occurrence and impacts of water scarcity and build heat tolerance. Goal 6 - building and celebrating Cape Town spirit - could be linked to a spirit of caring and nurturing, as Cape Town's nickname 'the Mother City' suggests. This could extend to caring for the most vulnerable within Cape Town's society, including those most vulnerable to climate impacts. It could also incorporate being custodians of the city's ecosystems on which we rely and from which we draw local identity, notably coastal, mountain and wetland ecosystems within the fynbos biome, which need to be given space if they are to adapt to changing climate conditions. Goal 6 - being an eco-friendly city region - would, in light of a changing climate, similarly include minimising the emission of greenhouse gases and other air pollutants, rehabilitating and maintaining ecosystem functioning, protecting threatened species, limiting water demands and protecting or adapting the city's coastline. As such, with climate change featured in the CTCDS as a key challenge and opportunity for the city, it can be read into all of the long-term goals set forth on the strategy.

In terms of priority interventions to meet the goals, the CTCDS foregrounds the need for new financing mechanisms to support households, businesses and public agencies to save water and energy and reduce greenhouse gas emissions, suggesting the establishment of a city-scale Climate Change Fund.

The CTCDS also articulates a need to link climate change measures with the imperative to create work opportunities in the face of high levels of unemployment in the city. The proposed mechanism is the expanded public works programmes. As such, the CTCDS promotes climate change investment and labour-intensive interventions to reduce climate risks while creating employment opportunities. So climate change certainly does feature in the CTCDS. The questions stemming from this are: (1) who or what influenced this articulation of climate change in the CTCDS; and (2) since 2012 and the adoption of the CTCDS, is there evidence of these climate related goals and interventions being further pursued?

8.7. How climate change came to feature in Cape Town's City Development Strategy

On the question of who shaped the articulation of climate change in the CTCDS, the document reflects a combination of priorities from various sources. Some represent priorities internal to the CCT, stemming from political and legislative mandates and involving considerable horse-trading amongst senior officials in various departments and politicians in various portfolio committees (interviews with CCT officials, April 2013 and February 2014; interview with EDP official, July 2015). Some priorities articulated in the CTCDS attempt to incorporate strong views and suggestions put forward by external stakeholders that were consulted as part of the CTCDS process and members of the public that responded to various requests for participation (interviews with CCT officials, April 2013; interview with EDP official, July 2015). Where these priorities internal and external to the city government intersect or align are where much emphasis is placed. That climate change features in the CTCDS was made possible by ongoing, more detailed climate change work being done both within the city government, led by ERMD, and by others in Cape Town, notably by researchers and practitioners at UCT, Sustainable Energy Africa and local consultancies. As described elsewhere in this dissertation, the CCT's ERMD had, since 2003, developed an Energy and Climate Change Strategy and Action Plan, prepared State of Energy Reports for Cape Town,

commissioned a Framework for Adaptation to Climate Change in Cape Town, developed sector-based CAPAs, commissioned a Sea Level Rise Risk Assessment, set up the Climate Change Think Tank and the Cape Town Climate Change Coalition. This work contributed to getting climate change onto the city government's agenda as an issue deserving of more attention, building an understanding of the local problems associated with the global phenomenon of climate change, and identifying key areas for intervention. This localised climate change information was fed into the CTCDS process through CCT departmental contributions and through external consultations, which included many of the local researchers, practitioners and consultants working on climate change. Also, the CTCDS deliberations and stakeholder consultations took place over the time that the Conference of Parties (COP17) of the UNFCCC was hosted in Durban, South Africa, which drew a considerable amount of attention to the issue of climate change locally and nationally, through news reporting, a public awareness campaign run by the CCT and the coordination of strong representation from Cape Town at the event. This may well have played a role in drawing attention to climate change considerations when envisioning the long-term future of the city and articulating it in the CTCDS.

Notable silences in the CTCDS around climate change linkages with health, safety or disaster management, and social justice point towards likely omissions in terms of who was involved in the consultations, deliberations and drafting of the CTCDS document, rather than a lack of relevance or importance of the issues. The imperative to reduce the risk of disasters and increase capacity to respond in the event of a disaster (climate related or otherwise) does not feature at all in the CTCDS. This omission is surprising considering the extent of disruptions, damages and losses periodically experienced in Cape Town from floods, fires and droughts. One might thereby expect explicit mention of a city future where such events were rare because measures had been put in place to decrease the susceptibility of communities, infrastructures and ecosystems to such occurrences, especially supporting those most

vulnerable to experiencing disasters (i.e. an equity concern), and capacity had been strengthened to deal with such extremes when they did occur. This omission suggests that those who work within the disaster management field, whether inside or outside of local government, were either not involved in the consultation and drafting process or were not sufficiently vocal to have this issue reflected in the strategy. This acts as a reminder of the many voices that are likely left out of the CTCDS process. No process can be completely representative and comprehensive, but such silences can seriously undermine implementation if critical implementers do not feel ownership of the strategy or key constituencies do not see their priorities reflected in the strategy.

Like cities the world over, the political leadership of the CCT and the Western Cape Province are heavily focused on the near-term delivery of public goods and services as quickly and cost-effectively as possible, as part of an effort to show results and increase party support for the next elections. This political short-termism is fuelled by those within the city's electorate that take a narrow view on city improvement, demanding more land for property development, the expansion of public infrastructure, and further roll-out of mainstream technologies (over new alternatives) with little or no consideration for the implications of such developments on other city residents, the local government budget and the longer-term sustainability of the city. This near-term orientation and demand for more of the same practically constrains long-term strategic planning efforts such as the CTCDS. Additionally, despite all the climate change research and progressive rhetoric in Cape Town, there remains a lingering scepticism of the severity and immediacy of climate change concerns amongst numerous influential people within the city, both in the public and private sectors, often under the guise of scientific uncertainty (interviews with CCT officials, May 2012 and July 2012; interview with CCT Councillor, July 2015). This situation undermines action on taking the priorities laid out in the CTCDS forward within the city government.

8.8. Positioning and influence of Cape Town's City Development Strategy

There is a diversity of perspectives on what position the CTCDS holds in the organisational decision-making framework of Cape Town's local government and thereby how influential the CTCDS is in shaping investments and activities. Within the SPU, the custodians of the CTCDS in local government, the CTCDS is seen as one informant of the transversal management system that the SPU had been tasked with developing and deploying (interview with CCT official, July 2015). The CTCDS is also said to have given direction to the Economic Growth Strategy (EGS) and Social Development Strategy (SDS) that the SPU were drafting at the time of adopting the CTCDS. Within the SPU, the EGS and SDS are seen as the documents that operationalise the vision and goals of the CTCDS, identifying medium-term actions, associated with quarterly objectives and monitoring within the transversal management system (interview with CCT official, July 2015). Climate change does not explicitly feature in either of these two strategies. Broad notions of vulnerability, safety, reliability, protection and sustainability do feature, but with no explicit connection to the climate, either past or future. Climate change does, however, explicitly resurface in the mandates of both the Green Economy, Energy and Climate Change (GEECC) Working Group and the Coastal Management Working Group, under the Economic Cluster. As such the CTCDS does arguably guide the work of the clusters and working groups, set up through the transversal management system, that are tasked with strategy execution (interview with CCT official, July 2015). It is through the work of the GEECC Working Group that a Climate Change Policy has been drafted and adopted for Cape Town (interview with CCT official, February 2016).

Senior political leadership in the CCT see it somewhat differently. In the Mayor's view the OneCape 2040 (the provincial strategy that the CTCDS was aligned with) is a more prominent guide to Cape Town's development than the CTCDS (CCT, Guide to City Strategies: Foreword by Executive Mayor, undated, p.3-4). While it stands to reason that these long-term development strategies (whether the

OneCape 2040 or the CTCDS) would sit at the apex of the decision-making framework, guiding short- and medium-term plans, in the Mayor's view this relationship is inverted. Rather than guiding the review and revision of the IDP, the Mayor sees the IDP as underpinning the CTCDS. This view is evident in the Mayor's foreword to the recently published 'Guide to City Strategies' document: "[The CCT's full strategy package] *begins with the five pillars: the opportunity city; the safe city; the caring city; the inclusive city, and the well-run city - the electoral mandate. At the departmental level, the five pillars have been incorporated into the City's Integrated Development Plan (IDP) which is, as per legislation, the City's strategic framework for this five-year period. Complementing the IDP is the OneCape 2040 and derived City Development Strategy vision, which describes the kind of city and region which we are trying to work towards in the long-term over a 30-year period... The IDP and the OneCape are, therefore, components of the same strategy. The IDP provides the programmatic details of the strategy while the OneCape describes long-term goals to which the IDP, and other subsequent IDPs, will work towards. The 'foundation strategy' represented by the IDP and the OneCape is supported by the Economic Growth and Social Development Strategies.*" (CCT, Guide to City Strategies: Foreword by Executive Mayor, undated, p.3-4).

When questioned about the relative importance and weight given to the CTCDS in shaping decisions, a senior and experienced politician in the City Council (interview, July 2015) cautioned against viewing such strategies and policies as blueprints. His view is that the city government is too complex for such prescriptions ever to succeed. Rather, he suggested, policies and strategies like the CTCDS provide guidelines that gradually reorient the work of local government through the way problems are looked at, priorities are set and budgets allocated. From his perspective the alignment between the city government's various policies, strategies and plans are improving, but is far from complete (interview with CCT Councillor, July 2015).

By contrast, many CCT officials who were involved in the CTCDS development process see it as having gone nowhere, as having failed and disappeared (interviews and informal discussions with EDP official and CCT officials, July and August 2015). "*I think what often happens, and I think it happened in this Cape Town process, is that at the end, after all the work of the CDS process, which is about two years, two and a half years, it went nowhere*" (interview with EDP official, July 2015). The reasons suggested for the CTCDS not being operationalised include: the strategy being internalised in the local government to deliver on, rather than furthering active engagement with multiple stakeholders in the implementation phase; that various competing priorities were included in the CTCDS but the trade-offs involved in integrating these priorities were never tackled; new advisers to the Mayor that came in during the final stages of developing the CTCDS began new strategy development processes that drew attention and energy away from the CTCDS; the IDP being tied to the CCT's annual budget resulting in it being given priority over all else such that anything beyond the 5-year IDP cycle does not hold weight and is effectively irrelevant, unless it is translated into the IDP framework; and finally that the real power within the municipality lies in the four or five large line function departments that generate and/or spend the bulk of the municipal budget, e.g. electricity, roads, water and sanitation, such that any overarching integrative framework that does not talk favourably to the core functions of those departments is effectively just a token that holds very little sway.

What is clear is that the CTCDS (CCT, 2012a) sits within a crowded and dynamic city-wide decision-making framework, populated with numerous strategies, policies and plans aimed at (re)orienting investments and activities. Not only is there the IDP, EGS and SDS, but also the Built Environment Performance Plan (CCT, 2014a) and the newly emerging Growth Management Strategy, Transit Oriented Development Strategy, Environmental Strategy and Climate Change Policy (CCT, 2017), all in various stages of drafting, consultation and approval, each envisaged to sit alongside and complement the other

existing strategies, policies and plans. This makes for a fragmented and complex decision-making environment, with each new strategy and plan running the risk of diluting the influence and effectiveness of the last. However, the emergence of climate change mandates under the economic cluster within the transversal management system is a positive step. While this cannot exclusively be credited to the existence of the CTCDS, it may well have played a role.

As for the creation of a Climate Change Fund and the creation of climate jobs through the Expanded Public Works Programme, put forward as priority interventions in the CTCDS, there is very little evidence of progress in implementing these ideas. Reviewing the latest version (2015/16 Review and Amendments) of the current 2012-2017 IDP yields no mention of a Climate Change Fund (CCT, 2015d). While the EPWP features as a priority within the IDP, with the aims of creating 200,000 EPWP work opportunities by 2017 and developing the relevant policy and institutional frameworks to implement the EPWP in the CCT's line directorates, there is no mention of particular emphasis and effort being placed on creating jobs that address climate change in some way. As such, the CTCDS cannot be said to be highly influential in the allocation of resources. It will be interesting to see if this differs at all in the next IDP.

In sum, climate change is explicitly acknowledged in the CTCDS and can be read into numerous of the goals and proposed priorities. As such the CTCDS provides the impetus and backing for actors within Cape Town's local government and beyond to act on addressing climate change and justify the allocation of resources to do so. This is most clearly manifest through the new Working Groups with climate change as part of their mandate, set up within the transversal management system. However, many of the priorities laid out in the CTCDS are broad and could be taken in any number of directions during the process of implementation. The CTCDS operates within an increasingly crowded city government decision-making space. The proliferation of new strategies and policies seem likely to dilute the influence of any

one process and resulting document. The CTCDS created an integrated and forward-looking perspective on development, including economic, social and environmental concerns and priorities, which enabled climate change to emerge as an important systemic and cross-cutting issue. However, the issues have since been separated out again into three 'operational' strategies. As a result, climate change has been largely lost from sight again at a strategic level. In response the city government, under the auspices of the GEECC Working Group and led by ERMD, took to drafting a Climate Change Policy (CCT, 2017, in order to draw attention to the issue, add weight to climate change considerations in the city-wide decision-making framework and give more specific guidance on what should be done to address local sources and impacts of climate change.

8.9. Emerging insights into strategic planning for adaptation

The CTCDS case shows that the long-term and broad scale perspective taken in strategic planning does allow for climate change issues to surface and become visible alongside (or in relation with) other key city-wide threats and opportunities in a way that is difficult to achieve in short-term and/or narrow sector specific planning processes. The inclusion of climate change as a long-term priority opens up a window of opportunity for those driving the climate change agenda locally to act and makes some contribution to encouraging those who are not aware of or concerned about climate change to (re)consider the climate dimensions of their work (e.g. through the establishment of a new inter-departmental working group with climate change as part of its mandate). The problem is that often climate change is simply added alongside other mainstream developmental priorities, such as economic growth, international competitiveness and service delivery, without sufficient attention given to how these interrelate to create trade-offs and/or synergies. This is particularly problematic because climate change priorities, when not related to priorities of service delivery, infrastructure development and

economic growth, do not then readily translate into the filters or criterion used in short to medium term planning (notably the 5 year IDP in the South African context) to prioritise which programmes and projects will be resourced. This confirms a similar finding by Hetz (2015) in the case of Johannesburg.

Irrespective of the strengths and weaknesses of the contents of the strategy, what the CTCDS case reveals is that city-wide strategic plans do not always hold as much weight within decision-making space and operational practices of local government, let alone other governance actors, as theory and international policy advice (from the likes of Cities Alliance and others) suggests. In theory, the CTCDS should inform and reorient the priority actions and allocation of resources contained in the 5-year IDP and create coherence and continuity between the IDPs. But in reality this seems not to be the case because there is not widespread ownership of the CTCDS, while the IDP with its links to annual budgets and performance targets drives local government action and thereby overrides the priorities laid out in the CTCDS. This confirms what a number of other authors have found and labelled short-termism in South Africa's local governments, which undermines the long-term agenda of urban climate adaptation (Roberts, 2010; Ziervogel and Parnell, 2012; Hetz, 2015). As Hetz (2015, p.10) notes: "*Although long-term issues are raised at the strategic level, including climate change adaptation, there is political pressure to attend to the most urgent and immediate development issues first*".

This case surfaces the need for caution to be exercised when interpreting results from studies looking at action on climate change in cities based on data from reviewing documents and/or interviewing or surveying only a few people in a city. This is often the case in international cross-city comparative research (for example Reckien et al., 2013). The case of Cape Town's CDS highlights that these strategy, policy and planning documents can look very progressive when it comes to acting on climate change and seem as if they hold significant weight in the decision making and functioning of the city. However, in

reality these documents misrepresent the extent to which the priorities reflect those of a city government as a whole, let alone those of multiple stakeholders beyond government, and thereby give an inflated sense of the level of investment and action being taken on climate change. This is especially true in developing country contexts, where external expertise is often brought in to run the strategy development process (often with international funding) and then the organisations tasked with convening the enactment and implementation of the priority measures do not have the mandate, capacity, authority and/or collective willingness to do so. This is not to say that strategic planning is not an important, if not essential, vehicle for building and realising the adaptive capacity of cities in the face of climate change. Rather it is to suggest that strategic planning cannot be the sole vehicle for furthering the implementation of urban climate adaptation. This case study thereby supports the assertion made by Carter et al. (2015, p.10) that a city's planning system is "*a key element of progressive long term urban adaptation responses*" but that "*the planning system's connection to short term political cycles constrains its use for achieving longer term progressive goals such as adapting to climate change*" (ibid, p.8).

8.10. Conclusion

This chapter, investigating the process of preparing, adopting and implementing Cape Town's CDS, finds that the inclusion of climate change considerations and responses in a city's long-term development strategy is a beneficial step in raising the profile of the issue and sowing the seeds of future action. However, the case study suggests that the inclusion of climate change into strategic urban plans is insufficient evidence to conclude that climate change is considered a priority by local government as a whole and is being addressed at the city scale. Within such city strategies often lie contradictions, contestations, silences and exclusions that undermine the legitimacy and functionality of the strategy, thereby severely constraining implementation.

Echoing an argument made by Parnell (2015) relating to African cities more generally, planning cannot be bypassed if climate risks and vulnerabilities are to be systematically addressed in cities, rather than simply having a set of climate adaptation and/or mitigation projects. But for the decisions that will reform planning to be effective, more work is needed to integrate climate adaptation objectives and actions into the wider technical and ideological discourses of developmental, anti-poverty, service delivery and infrastructure-led growth agendas that dominate the political landscape in most African cities. Read together, the literature and Cape Town CDS case study reveal the importance of getting climate change onto the strategic urban development agenda but the limited influence this has on the development trajectory of the city without widespread ownership of and commitment to the outcomes and a translation of these long-term outcomes into near-term priorities for allocating budget and other resources.

The findings suggest that urban climate change research needs to focus beyond simple (comparative) reviews of policy and planning documents. Much closer investigation of how the strategy came about and how it is institutionalised in the operations and activities of the urban actors or governance networks is required to understand the extent to which, and the means by which, such strategies change the decisions and operations that make and remake the city. The use of organisational ethnography and processual case research is shown to provide valuable methodological tools for entering into and not simply assessing the decision making processes that do so.

The next chapter shifts attention from the strategic level of planning the city as a whole, where climate change is being integrated into, or positioned alongside, other urban development priorities, to the sectoral level, where strategic priorities have to be translated into implementation. Chapter 9 presents

the third case study of an adaptation decision-making process in Cape Town, which looks at how the climate adaptation agenda gains traction within a branch of CCT's city administration mandated to manage stormwater and flood risk. The chapter presents an analysis of how information about projected future climate conditions has been included in master planning at the catchment scale to make decisions about infrastructure and land management in light of changing flood risks.

Chapter 9: Climate adaptation in stormwater management

9.1. Introduction

Having presented the CAPA case, where climate adaptation was the primary focus of the process, and then the CDS case, where climate change was included as one of many strategic development priorities for the city government in working towards a vision of Cape Town for 2040, this third case study deals with the technicalities of integrating projections of future climate conditions into the management of stormwater and flood risk in Cape Town.

One of the critical ways in which urban and climate conditions intersect is through flows of water that lead to flooding, erosion and pollution if not adequately dealt with. Ideally, a well-designed and managed city is capable of absorbing, capturing, filtering, utilising and draining water to increase the safety, health and well-being of its residents and urban ecosystems (Donofrio et al., 2009; Morison and Brown, 2011). This aspect of sustainable urban development is becoming increasingly critical as patterns of rainfall, temperature, sea levels and storm surges change in many parts of the world, including Cape Town (Brundrit and Cartwright, 2012; Hallegate et al., 2013; Döll et al., 2015).

The aim of this chapter is, firstly, to describe how climate risks are being factored into the ways in which stormwater and flooding are managed in Cape Town. Secondly, it is to identify key challenges associated with departing from business-as-usual of managing stormwater, which is based only on past climate information, to adapt in light of possible future conditions. The analysis presented in this chapter uses the concept of an adaptation pathway to understand how decisions aimed at reducing the risks and impacts of climate change emerge over time. The adaptation pathways literature is therefore revisited in the next section, before turning to the empirical evidence. The findings are derived from data collected

within the CCT's Stormwater and Sustainability Branch between November 2014 and May 2015 through participant observation, open-ended interviews with CCT officials, and reviewing a range of documentary sources. A case narrative and chronology is presented to depict the sequence of events, engagements and outputs within the decision-making process. The adaptation pathways conceptual framework is then applied to make sense of the process from an adaptation perspective and identify patterns or themes that characterise the adaptation process more broadly. Doing so highlights a number of challenges faced in undertaking climate adaptation in practice and suggests some weaknesses in the current conceptual model of climate adaptation as pathways.

9.2. Revisiting the adaptation pathways literature

An adaptation pathway can be defined as the sequencing of decisions, over decadal timescales, to select and implement climate adaptation measures, accounting for irresolvable uncertainty, unacceptable levels of risk and excessive or wasteful expenditure (Reeder and Ranger, 2011; Haasnoot et al., 2013). The concept has mostly been used in a forward-looking sense to sequence future adaptation actions may be deemed technically robust and socially acceptable under various scenarios, notably in the UK's Thames Estuary (Reeder and Ranger, 2011), the Rhine Delta in the Netherlands (Haasnoot et al., 2013), New York City (Rosenzweig and Solecki, 2014), and Lakes Entrance (Barnett et al., 2014) and the Murray-Darling Basin in Australia (Abel et al., 2016).

Wise et al. (2014) and Gorddard et al. (2016) critique the early work on adaptation pathways as not adequately accounting for the social and institutional aspects of decision making. They draw attention to the decision context within which the adaptation agenda is situated, promoting careful consideration of the complexities and uncertainties pertaining to: (1) knowledge of the system in question that is being

developed, managed and adapted; (2) the goals and underlying values of any policy or actions; and (3) the distribution of power, encoded in rules, that shape decision making and implementation. Wise et al. (2014) suggest it is useful to distinguish between two levels of adaptation: (1) *incremental actions* within the prevailing governance regime that address proximate causes of vulnerability or developmental needs, and (2) *transformative adaptation* that entails changing the rules and values that frame decisions and assign power in the decision process to produce a more just and fair society in light of global environmental change. Wise et al. (2014 p.332) argue that socio-institutional enablers and constraints need to be better understood in order to progress adaptation, pointing to the importance of historical context by suggesting that "*the current status of the system and its future trajectory are heavily influenced by the past*". This 'antecedent pathway' provides an indication of 'institutional preparedness' for future climate adaptation. It is when institutions are not prepared to enable the social processes needed to realise a fairer and more sustainable society that incremental adaptation is deemed insufficient to address the root causes of climate risks and transformative adaptation is required (Wise et al., 2014).

This chapter responds to the call by Wise et al. (2014) to look back at what has been done previously (i.e. to chart the antecedent pathway) as a basis for identifying social and institutional challenges associated with ongoing adaptation in a given context. It does so by investigating how climate change has been incorporated into the management of stormwater in Cape Town and what this reveals in terms of institutional preparedness for adapting into the future. The adaptation pathways framework is used here as an analytical tool applied retrospectively. The CCT has not used the pathways approach to guide how stormwater is managed, although there is the potential to do so, a point that will be returned to in the chapter's conclusion.

9.3. Managing stormwater in Cape Town

Rainfall varies considerably across Cape Town, both spatially and between years, because of topography and local weather systems. As a city comprised of many small catchments, short duration and high intensity rainfall events generate run-off that periodically causes flooding associated with damage to property and infrastructure, the disruption of movement, economic activities and important services, and in extreme cases threatens lives (DiMP, 2010; Pharoah et al., 2016). Parts of Cape Town are also characterised by a high groundwater table that, in times of prolonged rainfall, creates standing flood water. As a coastal city, Cape Town is also susceptible to flooding caused by storm surges that push sea water further inland. Flooding is a persistent problem facing Cape Town, but some areas, households and businesses are more vulnerable than others, based on their location, quality of infrastructure, access to services (e.g. refuse removal and insurance), and financial capacity to recover from losses and damages (Ziervogel et al., 2014a). As a city with high inequality, many residents live in low-income and informal settlements with minimal public services. The lack of adequate sanitation and waste removal services increases the amount of contaminates entering the water system, increasing the pollutant loads and creating blockages, especially during periods of high temperature and minimal rainfall (i.e. reduced low-flows).

Urban stormwater management involves dealing with water run-off from the built environment to limit the risks of flooding and water pollution. Increasingly, it also involves managing runoff to limit the degradation of ecosystems and make water available for reuse (CCT, 2013b; Walsh et al., 2016; Mguni et al., 2016). As Cape Town's urban footprint grows and land cover changes from vegetation to hardened surfaces, so the volume, rate and pollutant load of run-off continue to increase (Thomas et al., 2010; Haskins, 2012; CCT, 2014b). Patterns in rainfall, temperature, river flows, groundwater levels and sea levels have to be factored in when designing, operating, maintaining and expanding the city's stormwater

system to keep the risk of flooding, water pollution and ecosystem degradation at acceptable levels. Climate change, together with urban development, is increasingly affecting those patterns and thereby needs to be included when determining risk levels and working towards achieving and maintaining levels that are deemed acceptable.

Cape Town's stormwater system comprises a complex and extensive network of natural and engineered features, including streams, rivers, wetlands, pipes, surface canals, channels, swales, stormwater ponds, dams and pumping stations (CCT, 2015e). The replacement value of the stormwater infrastructure network was, in 2009, conservatively estimated at R13 billion (CCT, 2013c). The coverage, age and quality of the current system varies considerably across the city. Within the resource constraints of the municipality, this gives rise to difficult decisions weighing up relative costs and benefits associated with maintaining and upgrading existing infrastructure and expanding the network to underserviced areas. The historical legacy of inequality makes these decisions particularly difficult. Projected future urbanisation and climate change makes them even more so.

Responsibility for managing Cape Town's stormwater is assigned to the Stormwater and Sustainability Branch[26] within the CCT. Reflecting conceptual, legislative and policy developments at the national and international levels, the Stormwater Branch has, over the last 15 to 20 years, been shifting from an engineering focus of efficiently piping stormwater away to a sustainability focus of facilitating stormwater absorption into ecosystems as naturally as possible (Obree, 2004; Haskins, 2012). An integrated and sustainable approach to stormwater and catchment management was formalised in the CCT's 2002 Catchment, Stormwater and River Management Strategy. The strategy was strengthened by

[26] Prior to 2014 it was named the Catchment, Stormwater and River Management (CSRM) Branch, and previous to that the Catchment Management Branch. For simplicity it will be referred to as the Stormwater Branch throughout this chapter.

two policies adopted by Council in 2009. The Floodplain and River Corridor Management Policy (CCT, 2009a, p.5) sets conditions and limits on new developments close to wetlands and rivers to achieve "*balanced consideration of potential flood risk, environmental impacts and socio-economic needs*". The Management of Urban Stormwater Impacts Policy (CCT, 2009b) introduced principles of Water Sensitive Urban Design (WSUD) and parameters for Sustainable Urban Drainage Systems (SuDS) into the process of development applications and approvals, directly influencing planning and design. The policy targets a reduction in the quantity of stormwater runoff and in the phosphorous and sediment load of stormwater to improve water quality, thereby emphasising ecological health and sustainability in drainage management. Climate change was not a primary motivating factor for introducing WSUD and SuDS to deal with detrimental impacts of urbanisation on receiving waters. However, the benefits of these approaches for positioning stormwater as a resource to supplement water supplies are now actively being considered in the light of climate change. Both stormwater policies were integrated into the CCT's Spatial Development Framework and Integrated Development Plan (Haskins, 2012). Considerable progress has been made in institutionalising principles of sustainability in the Stormwater Branch, and CCT as a whole, yet full realisation of sustainability in practice is far from complete (Davidson et al., 2015). The shift to sustainability has opened up opportunities for addressing questions of climate change.

9.4. Adapting the way stormwater is managed

The discourse of climate adaptation is not evident in the work of the Stormwater Branch, where concepts and language of risk mitigation and sustainability dominate. However, there are strong conceptual and practical linkages between climate adaptation, risk management and sustainability (Swart et al., 2003; Solecki et al., 2011), and the process of adapting the management of stormwater in response

to climate change is evident in Cape Town over the last decade. The process is described below as an adaptation pathway with six key features.

9.4.1. The 2004 flood event

"We became acutely aware of climate change questions around the time of the August 2004 large flood event... we commissioned some research to analyse the damages and impacts of the event and also to look at whether any change in rainfall was evident... this event and study got climate change onto the agenda... we moved forward with some trepidation... it makes sense to be conservative in the face of uncertainty and then to re-assess as new data and information comes to light... so getting climate change in is a process, it is still in its infancy, there are still things to be verified, but as a forward-looking coastal city it makes sense to do it." (Interview with CCT official, March 2015).

A large flood in 2004 began raising questions of climate change for CCT officials working in the Stormwater Branch. Consequently, an inter-disciplinary post-flood assessment was commissioned from UCT, undertaken by a team of disaster management specialists and climate scientists. It included an analysis of rainfall data to identify if any long-term trends were evident. The assessment showed that the flood was caused by the culmination of two storm systems passing over the city, bringing heavy rainfall that led to quantifiable losses in excess of R6.5 million (DiMP, 2005 and 2010). The study suggested that, while the average annual rainfall totals had not changed significantly over recent decades, the seasonality and intensity of rainfall may have altered, but more data were required to confirm this (DiMP, 2005). The study raised concerns regarding potential future increases in the intensity and frequency of storm events, heavy rains and extreme flows under scenarios of climate change, requiring further research. The study findings were used by the Stormwater Branch to motivate for completing the annual maintenance work

on the stormwater system in June, instead of April, to account for a later onset of the rainy season (interview with CCT official, March 2015).

9.4.2. Environment department leads the way

Between 2005 and 2008 work on addressing climate change grew within the CCT's ERMD, notably including the development of the Energy and Climate Change Strategy, the preparation of a Climate Adaptation Plan of Action, and commissioning a Global Climate Change Sea-Level Rise Risk Assessment for the CCT (Brundrit and Cartwright, 2012; Taylor, 2016). These activities included various consultations between ERMD and Stormwater Branch staff on issues relating to climate change, stormwater and flooding, opening up dialogue and debate within the CCT's administration over the extent of local risks posed by climate change and the nature and suitability of proposed responses (CCT internal communication, 17 April 2009). These engagements remained largely within the technical realm, out of the political and public domains. Initiatives by ERMD added weight to the climate change agenda, but did not initially link directly to the core ongoing work of the Stormwater Branch. The potential for creating collaborative linkages between ERMD and the Stormwater Branch on climate change issues emerged through strategic planning.

9.4.3. Stormwater strategic planning

In 2005, the Stormwater Branch commissioned the development a city-wide approach to managing and upgrading the stormwater system. This involved performing a high-level demand prediction, creating an asset register, and estimating a ten-year expenditure framework. The consultants noted that climate change was not included as a factor in forecasting demand for stormwater services and calculating expenditure (SibaCon, 2006). The study recommended that a consolidated Stormwater

Masterplan be developed for the entire metropolitan area, as a basis for detailed planning to manage and operate existing stormwater infrastructure assets and prioritise the acquisition and construction of new assets. It was this recommendation that led the Stormwater Branch to identify the need for, and opportunity to, include climate change in the modelling of catchments.

The Salt River was the first catchment to be modelled for a master-plan. This was a pilot to "*enhance the CCT's ability to plan future provision and upgrade of stormwater infrastructure, determine service levels, improve development control and undertake scenario planning associated with urban densification, climate change and maintenance regimens*" (CCT internal communication, 30 September 2009). In July 2009, consultants were appointed to undertake the work. This included an analysis of rainfall and flow data, the quantification of potential climate change impacts on rainfall, the development of a prototype Climate Change Factor to account for uncertainty in future rainfall patterns, and the preparation of design storms for use in the catchment modelling across the city. Researchers at the University of KwaZulu Natal (UKZN) were sub-contracted to do the rainfall analysis component. Using statically downscaled climate data[27] derived from five GCMs, forced with one emissions scenario, the UKZN researchers simulated hydrological attributes of sub-catchments in and around Cape Town (Schulze et al., 2010). A ratio was calculated between the hydrological attributes simulated for two future periods (2046-2065 and 2081-2100) and the recent past (1971-1990) from each of the GCMs. While the results varied considerably between models, catchments and variables (i.e. rainfall durations and return periods), the study recommended adopting a conservative position when developing hydraulic designs in light of future conditions. Based on the average of the ratios from the GCMs yielding the two highest values, Schulze et al. (2010) recommended increasing design rainfalls by 15%. They also recommended that the study be updated in 3 to 5 years, when more and better climate data and improved analytical techniques

[27] Developed by the Climate System's Analysis Group at the University of Cape Town

are available to further refine changes in design rainfalls. The Stormwater Branch decided to increase design rainfall intensity by 15%, with the intention of reviewing this decision as new scientific evidence became available (interview with CCT official, March 2015).

The 15% increase was added to the gridded design rainfall data developed by Smithers et al. (2010) for use in the modelling and master-planning of the Salt River catchment and subsequent catchments. The inclusion increased the area designated as floodplains and high hazard zones, thereby expanding the land area where limitations and conditions are set on developments and where additional stormwater interventions are planned to reduce flood risk to existing developments. In addition to being used in master-planning, the design rainfall grid replaces the old Intensity-Duration-Frequency curves used in designing all stormwater facilities and infrastructure in Cape Town (interview with CCT official, December 2014). The development of the design rainfall grid to include a prototype Climate Change Factor marks a significant departure from the business-as-usual of managing stormwater based only on historical rainfall data. However, the new design rainfall data is yet to be comprehensively applied as master-planning has not been completed for all catchments across the city. This is partly due to budget constraints, staff turn-over and organisational (re)structuring that puts planning and contracting on hold (interview with CCT official, April 2015).

9.4.4. External influences and policy making

The impetus for including climate change considerations in stormwater management came not only from within the CCT. The Stormwater Branch heard from municipal colleagues in Durban that they had already commissioned UKZN to analyse rainfall and run-off data in light of climate changes, thereby increasing their confidence to follow a similar approach (interview with CCT official, March 2015). Also, in early 2009, the Western Cape Provincial Government commissioned a study on stormwater and climate

change in the region, which focused on water sensitive urban design and the inclusion of sustainable urban drainage interventions as an important component of dealing with increasing flood risk under scenarios of climate change (interview with CCT official, December 2014). The provincial government was also finalising a Western Cape Provincial Climate Change Response Strategy and Action Plan that involved hosting a climate change forum for Provincial and CCT officials, including a Stormwater Branch representative. The aforementioned work of ERMD, plus that of Durban's eThekwini Municipality and the Western Cape Provincial Government, added weight and impetus to the Stormwater Branch using climate change as one of many reasons for taking a sustainable approach to managing the city's stormwater system, as articulated in the 2009 Floodplain and River Corridor Management Policy (CC, 2009a) and Management of Urban Stormwater Impacts Policy (CCT, 2009b). These policies signalled a strong intent to shift the stormwater management paradigm from one of efficient water removal to one of ecologically sensitive and sustainable integrated water management that is forward-looking.

9.4.5. Climate Change Think Tank

The climate-related work of ERMD and the Stormwater Branch converged in 2009 through the formation of the Climate Change Reference Group, which became the Climate Change Think Tank (Cartwright et al., 2012b). It was designed to facilitate collaboration between researchers, consultants and local government officials to better understand and prepare for climate change. Work was structured around four research themes, one of which focused on the local consequences of climate change at the interface between marine and freshwater systems, led by the Stormwater Branch. This presented an opportunity to extend the work already underway to prepare a high-level masterplan for the Salt River catchment. The extension focussed on developing a detailed case study of the Salt River catchment to test various scenarios of the combined effects of increases in storm surge, mean sea level, rainfall and freshwater run-off on flood risk and infrastructure damage over a 50-year time horizon.

In 2010, consultants were commissioned to estimate local sea-levels at the mouth of the Salt River for various return periods, under current conditions and scenarios of climate change for 2035 and 2060 (PRDW, 2011). The study built on the sea-level rise modelling completed as part of the Global Climate Change Sea-Level Rise Risk Assessment for the CCT study commissioned by ERMD (Brundrit and Cartwright, 2012). It in turn fed into the flood modelling being done for the Salt River catchment high-level masterplan to simulate flood routing. The study found that the upper estimate of climate change conditions[28] resulted in a predicted increase in maximum high tide water levels at the mouth of the Salt River from +1.90m to +2.57m above mean sea level (MSL) for the 1:20 year return period and from +2.01m to +2.70m MSL for the 1:100 year return period by the year 2060. These increases in water levels resulted in overtopping volumes increasing by an order of magnitude, signalling the potential of significantly increased damages to coastal defence structures around the Salt River Canal and the infrastructure behind these defences (PRDW, 2011; Harris et al., 2012). The consultants also investigated the correlation between extreme storm surges in Table Bay and intense rainfall events in the catchment of the Salt River, to establish if the one in a hundred-year storm surge event should be combined with the one in a hundred-year rainfall event when calculating flood levels. Using limited available rainfall data, the findings suggest that these events do not occur concurrently (Harris et al., 2012). The inclusion of these results in the flood modelling of the Salt River catchment revealed the inadequacy of the existing river channel and floodplain area to cope with a one in a hundred-year flood and expanded the area delineated as floodplains and high hazard zones.

[28] downscaled from ten GCMS by climatologists at UCT's Climate Systems Analysis Group

9.4.6. Building on the Salt River pilot study

Based on results from the Salt River study, the Stormwater Branch has promoted a number of climate risk reduction (or adaptation) measures. These measures include: supporting and commissioning further research on flood risk assessment and preparedness; improving policy implementation to regulate urban development; adjusting the timing and intensity of maintenance activities; and communicating to other stakeholders the potential impacts of climate change, how the CCT is responding and what more is needed (interview with CCT official, March 2015). Many of these measures are included in the final version of the Climate Adaptation Plan of Action (CCT, 2011c). However, implementation has been slow to materialise, requiring additional resourcing, collaboration with other CCT departments and external stakeholders and political will (Taylor, 2016). The rainfall Climate Change Factor and sea-level rise projections were incorporated in subsequent modelling and master-planning of the Eastern catchments[29] in 2013. The intention is that the remaining two regions will be modelled and masterplans developed using the same methodology. However, shortages in funding, changes in staffing, and CCT organisational redesign have postponed these initiatives.

9.5. The challenges of navigating adaptation pathways

The investigation of climate change implications for managing stormwater and introduction of adaptation measures, described above and summarised in figure 12, is understood as an antecedent adaptation pathway made up of numerous decision points over time. The case study reveals a number of important challenges associated with navigating urban climate adaptation pathways.

[29] The Eastern catchments include the Kuils - Eerste River system and the Lourens, Sir Lowry's Pass and Soet Rivers.

Figure 12: Timeline showing the antecedent adaptation pathway of stormwater management in the CCT

The first challenge pertains to the temporal nature of adaptation pathways. The Cape Town stormwater case reveals the long lead time required to build the knowledge base and lay the planning and policy groundwork to enable the detailed design, selection and implementation of adaptation measures. The assessment and preparatory work for including climate change considerations in Cape Town's stormwater management has been underway for over ten years and still it is far from complete. For example, the flood modelling work and master planning has yet to be completed for all catchments. Realistic lead time is thereby critically important to factor into the design of future adaptation pathways. This applies to other CCT departments and line functions, as well as other cities.

Another important temporal challenge is that once a decision is taken, the lifespan of that decision is often longer than initially intended. This is because review and revision is resource intensive and there are many other competing demands. For example, the analysis that led to the decision to include an extra 15% rainfall intensity in the design rainfall data was completed in 2010. Recognising rapid developments in the science, there was an expressed intention to review that figure every five years. Yet six years later, a review is not yet on the agenda or in the budget. The resources needed to complete the catchment modelling are yet to materialise and therefore the revision of the rainfall data is not a priority. Also, many of those involved in commissioning the original study and making resulting decisions have left the Stormwater Branch. Although the associated documents remain, much of the knowledge and institutional memory of the work and resulting decisions leave with these officials. The lack of review mechanisms limits the CCT's current capacity for proactively navigating adaptation pathways.

The second challenge is coordinating between the multiple actors that play a critical part in shaping and progressing a city's adaptation pathway. The case shows that intersections between work of the Stormwater Branch, Environment Department, Provincial Government, two universities and five

consulting companies have given rise to the changes made. More coordination and collaboration is required within local government and with others to further progress adaptation efforts. For example, collaboration between the Stormwater Branch, the Disaster Risk Management Centre and the insurance industry is needed to manage increases in flood risk to areas that are already developed. From a theoretical perspective, the fact that the Stormwater Branch is only one of a number of actors progressing the climate change adaptation agenda within Cape Town suggests there may be value in characterising pathways in three dimensional space. This entails conceiving of a city's adaptation pathway not only as a sequence of decisions between adaptation measures over time, but also as being influenced by various actors.

A third challenge evident in the study is the complex relationship between knowledge and decision making. It is interesting to note that the decisions documented above were all driven and made by officials in the city administration and not by politicians, who are often assumed to be the decision makers. This is, in part, a result of the complex and contingent nature of the scientific knowledge underpinning the decisions. It requires considerable technical expertise to interrogate and assimilate the range of results accounting for numerous possible scenarios with extensive spatial heterogeneity at the local scale. That said, many of these decisions have potentially far-reaching implications for the development of the city and the allocation of public resources, suggesting that the decisions should also be debated and weighed up within the political domain of a democratic system. Much of the evidence base underpinning the decisions remains locked away in technical consulting reports that are not easily accessible to others outside of the unit that commissioned them. This undermines collaborative, integrated and inclusive decision making.

9.6. Conclusion

This chapter presented an application of the adaptation pathways approach as an analytical tool to understand and make legible the process of integrating climate change considerations into managing stormwater in Cape Town. The framework helped identify key decision points, the actors involved, and the temporality of the process. The application revealed a weakness in both the framework and the case for engaging the politics of decision making. This political dimension may be a critical part of explaining and addressing the three challenges for progressing adaptation identified through this case study, those of (1) reducing the long lead time for decisions and the persistence, yet incomplete application, of those decisions, (2) strengthening the coordination and collaboration between multiple actors with a stake in city-wide climate adaptation, and (3) combining the technical expertise to deal with the complex and evolving knowledge base with the political expertise to address contested trade-offs and value-based judgements that underpin these decisions.

The chapter focused primarily on challenges that give rise to the slow, partial and incremental progress being made to address climate change in Cape Town. However, it must be said that the Stormwater Branch has made considerable inroads into confronting questions of climate change that set it apart from many other CCT departments, as well as counterparts in many other cities around the world. Strategic leaders and skilled technicians should be given due credit for this progress, as should those around them helping to create a conductive and supportive environment for undertaking such work. That said, there is much more to be done to build the climate resilience and sustainability of Cape Town in the face of changing climate patterns and sea levels. How this is done needs to be informed by the existing challenges identified in this chapter by charting, in the case of stormwater management in Cape Town, what is called the antecedent pathway in the adaptation pathways model.

In the next chapter a number of modifications to the adaptation pathways model are proposed, drawing on the rounds model of decision making. A potentially interesting next step for further co-producing knowledge between researchers and CCT practitioners could be to test the revised model as a diagnostic tool to support CCT decision making. Doing so could open up technical and political deliberation over pathways that transition from incremental measures addressing proximate causes of flooding and water pollution to those that are transformative in addressing the root causes and unequal distributions of such risks and vulnerabilities. Such an initiative would require and enable deeper engagement and collaboration between technical and political stakeholders within and beyond the CCT local government, addressing stormwater in relation to other water service sectors, as well as those of sanitation, waste management, environmental management, disaster risk management, spatial planning and alike. Aligning with recommendations put forward by Wise et al. (2014), such an initiative would need to create the space and opportunities to innovate and experiment with alternative values, ideas and practices by enabling a range of actors, with different power and agency, to renegotiate the prevailing distributions of resources, rights and responsibilities in light of addressing climate change and urbanisation in a sustainable, resilient, inclusive and equitable way. As evidenced in this study, creating such spaces for innovation and experimentation is difficult to do in large and complex organisations such as city governments. Learning from the challenges of the CAPA process, presented in chapter 7, such an initiative would need to be led by a strategic high-level body, such as the CCT Green Economy, Energy and Climate Change Working Group or the Section 80 Water Resilience Committee. This might reduce some of the budgetary, staffing and restructuring constraints faced within the Stormwater Branch, while increasing the influence, extent and effectiveness of resulting decisions. The current drought crisis facing Cape Town provides a policy window (in the language of the streams model) for exploring more transformative approaches to managing water, including stormwater, in the city. The work of Pelling et al. (2014), Bulkeley et al. (2014) and Leach et al. (2012) on transformation, climate justice and sustainability

pathways may provide fertile ground for finding ways to enhance the political aspects of the adaptation pathways framework.

Having presented each of the three processual case studies of climate adaptation decision making in Cape Town, the next chapter uses the four conceptual models identified in the climate adaptation and decision-making bodies of literature to read across these case studies. The next chapter discusses how a conceptual framework that views urban climate adaptation as a process of decision making helps to make sense of the variety of evidence that can be found when studying climate adaptation from inside a city government.

Chapter 10: Analysis and discussion across cases

10.1. Introduction

The preceding three chapters on developing climate adaptation plans, city-wide strategic planning and stormwater management in Cape Town have dealt with each of the adaptation process case studies separately, describing the case with an ethnographic sensibility, i.e. largely in the terms used by those directly involved in each process, and identifying key themes and insights that emerge. This chapter uses the conceptual frameworks identified in reviewing the adaptation and decision-making literature, presented in chapters 2 and 3, to look across all three case studies, identify the inter-linkages between them and better understand the larger, aggregate or composite urban adaptation process, especially from an organisational and governance perspective.

The model of adaptation as a cycle of phases or steps is first applied to the three case studies to see what it offers as a means to characterise and explain the evolution of the adaptation processes observed in Cape Town and to suggest what empirical findings the cycle model does not adequately capture or represent. The same is then done for the adaptation pathways model, the streams model of decision making and the rounds model of decision making. Based on the findings from applying the four models to the three Cape Town case studies, how can Cape Town's process of urban climate adaptation be conceptualised and better understood, such that the resulting conceptual model might assist both in guiding future efforts and in understanding processes of urban climate adaptation elsewhere? This question is tackled in order to clearly articulate the theoretical developments proposed by this doctoral study. This chapter thereby aims to advance knowledge firstly by testing and critiquing existing conceptual models of climate adaptation and decision making through applying the models to make sense of the

empirical findings in the three Cape Town case studies, and secondly by proposing a new conceptual framing of climate adaptation that builds on insights offered by organisational decision theory.

For ease of reference when reading across the three case studies, the table below provides a consolidated timeline of the climate adaptation related decisions and activities undertaken by local government in Cape Town. The information that populates table 4 has been summarised from the Cape Town context chapter and the three case study chapters, as indicated in the final column of the table.

Table 4: Consolidated Cape Town climate adaptation timeline

Year	Decision / activity	Relevance
2001	Integrated Metropolitan Environment Policy (IMEP) adopted by CCT Council containing first official mention by city government of climate change concerns for Cape Town	Context; CAPA case study
2002	Integrated approach to catchment management based on principles of sustainability formalised in Catchment, Stormwater and River Management Strategy	Stormwater case study
2004	Large flood event impacted many parts of Cape Town raising questions about changes in rainfall intensity under climate change within CCT's Stormwater and Sustainability Branch	Stormwater case study
2005	Post-flood assessment completed to determine quantifiable losses and explore rainfall patterns, commissioned by CCT from UCT research team	Stormwater case study
	Cape Town's Energy Futures Study completed for CCT by the UCT and Sustainable Energy Africa (SEA), subsequently updated in 2011	Context
2006	Energy and Climate Change Strategy finalised and adopted by CCT, supported by SEA and UCT	Context; CAPA case study
	Framework for Adaptation to Climate Change in the City of Cape Town (FAC4T) finalised, commissioned by CCT's Environmental Resource Management Department (ERMD)	CAPA case study
	Framework Stormwater Infrastructure Management Plan commissioned by Stormwater and Sustainability Branch completed, recommending high-level master planning for entire city	Stormwater case study

2008	Work begins on developing a CDS based on a long-term vision for Cape Town in 2040	CDS case study
	Global Sea Level Rise Risk Assessment for the CCT study completed, commissioned by ERMD	Context; stormwater case study
	Climate change concerns and interventions first included in the CCT's Integrated Development Plan	Context
	Energy and Climate Change Committee created as oversight committee with a strong mitigation focus	Context; CAPA case study
2009	Draft CDS framework for Cape Town, produced by Spatial Planning and Urban Design (SPUD) department in CCT	CDS case study
	First version of city-wide CAPA completed, commissioned and guided by ERMD	CAPA case study
	Cape Town Climate Change Think Tank established by CCT and UCT's African Centre for Cities to advance climate change research, policy and practice in Cape Town	Context; CAPA case study; stormwater case study
	CCT Executive Management Team Subcommittee on Energy and Climate Change constituted to support implementation of the Energy and Climate Action Plan (ECAP finalized in 2010) and CAPAs	Context; CAPA case study
	Floodplain and River Corridor Management Policy and Management of Urban Stormwater Impacts Policy adopted by City Council, both citing climate change as one of problems the policies seek to address	Stormwater case study
	Report on Stormwater and Climate Change for Western Cape Province produced for provincial government	Stormwater case study
	Salt River catchment masterplan commissioned by Stormwater and Sustainability Branch, including the quantification of potential climate change impacts on storm rainfall for use in the catchment modelling	Stormwater case study
	Western Cape Provincial Climate Change Response Strategy and Action Plan finalised and Provincial government hosts a climate change forum that includes CCT officials	Context; stormwater case study
	Sectoral CAPA drafted by ERMD reviewed by Stormwater and Sustainability Branch officials who recommended specialist input before submission for formal adoption	CAPA case study; stormwater case study

	Development, implementation and review of the CAPAs explicitly committed to in the Environmental Agenda 2009 – 2014	CAPA case study
2010	Multi-hazard disaster risk assessment undertaken for CCT by Aurecon identifying climate change as a key hazard	Context; CAPA case study
	CCT signs up to the Global Cities Covenant on Climate, known as 'The Mexico City Pact', a voluntary initiative of mayors and local authority representatives to advance climate actions	Context; CAPA case study
	CCT's Energy and Climate Change Plan (ECAP), developed by the Energy and Climate Change Unit within the ERMD, completed and approved by City Council	Context; CAPA case study
	Rainfall analysis commissioned by CCT completed by academic consultants at University of KwaZulu Natal and decision taken to include climate change factor of 15% increase in rainfall intensity	Stormwater case study
	Consultants commissioned by CCT to design and undertake multi-stakeholder consultation process for developing the CDS	CDS case study
2011	Gridded design rainfall data including a climate change factor of 15% increase in rainfall intensity replaces intensity-duration-frequency (IDF) curves previously used in designing stormwater infrastructure	Stormwater case study
	Study of local consequences of climate change at the interface between marine and freshwater systems in the Salt River catchment completed through the Climate Change Think Tank	Stormwater case study
	CCT Flooding and Storms Disaster Risk Management Plan updated and re-issued	Context; CAPA case study
	Mistra Urban Futures partnership set up between CCT and ACC to co-produce knowledge of issues of urban sustainability, including climate adaptation	Context
	Cape Town Climate Change Coalition, an alliance of Cape Town-based organisations, including private sector, governmental and non-governmental organisations, researchers and educators, launched to support Cape Town's bid to host COP 17 and awareness of climate change issues in Cape Town	Context
	7 sectoral CAPAs completed and signed off by relevant department directors and oversight committees: Catchment, River and Stormwater Management; Coastal Management; Disaster Risk Management; Health; Human Settlements; Spatial Planning; Water and Sanitation	CAPA case study; stormwater case study

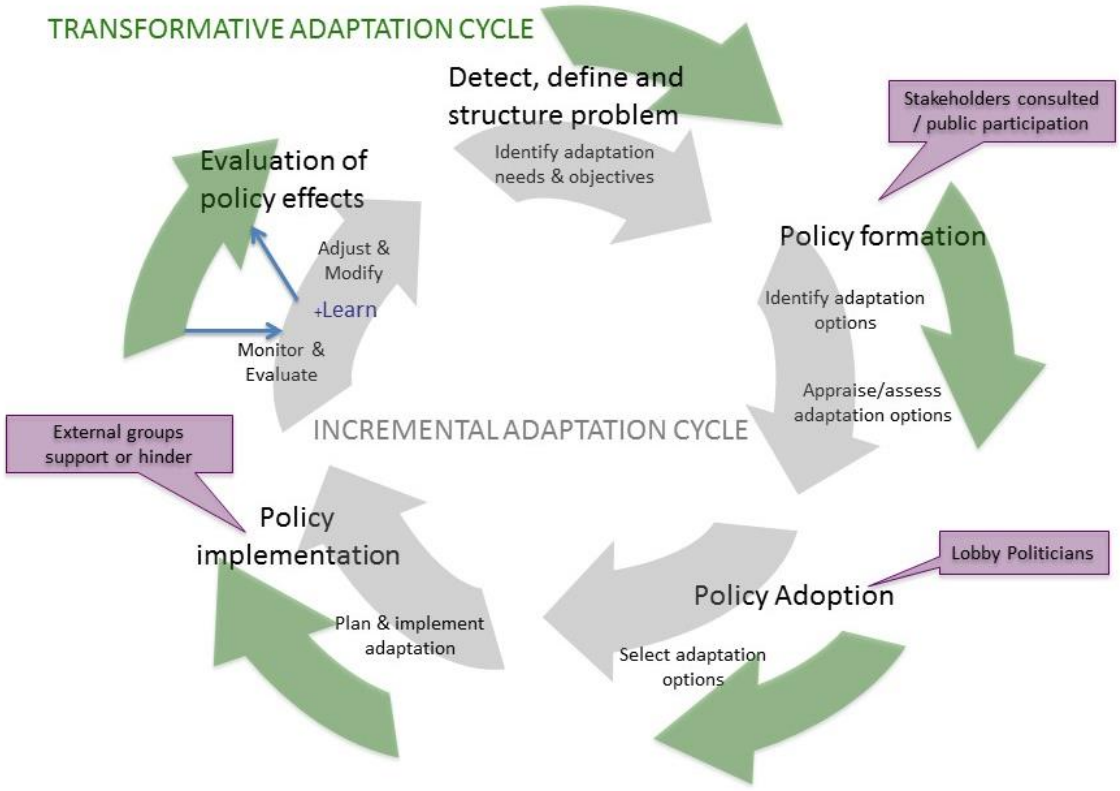
	CCT signs the Durban Adaptation Charter for Local Governments at COP17 committing to upscale and accelerate their climate adaptation efforts	Context; CAPA case study
	South African National Climate Change Response White Paper finalised and adopted	Context
2012	Future Cape and CDS processes brought together in OneCape 2040 under auspices of the newly formed Economic Development Partnership (EDP)	CDS case study
	Development, implementation and review of the CAPAs explicitly committed to in the statutory Integrated Development Plan 2012 – 2017	CAPA case study
	CCT's Climate Change and Coastal Zone Process Hazards Disaster Risk Management Plan issued	Context; CAPA case study
	CCT defined coastal setback lines to reduce the risks associated with sea level rise and storm surges	Context; CAPA case study
	Cape Town City Development Strategy adopted by City Council with climate change as a key consideration in the future development of Cape Town	CAPA case study; CDS case study
	City Council adopts the Cape Town Spatial Development Framework (SDF), integrating stormwater policies, as a component of the Integrated Development Plan (IDP)	Context; CAPA case study; stormwater case study
2013	Draft Integrated Coastal Management Policy, factoring in the findings from the Global Sea Level Rise Risk Assessment for the CCT, submitted by ERMD to CCT's Economic, Environment and Spatial Planning Portfolio Committee for approval prior to public participation	Context; CAPA case study
	Modelling and masterplan of the Eastern catchments completed including the Climate Change Factor of 15% increase in rainfall intensity and projected local sea level rise	Stormwater case study
2014	CCT joins the C40 Climate Leadership Group, a network of the world's megacities committed to acting both locally and collaboratively to address climate change through measurable and sustainable action	Context; CAPA case study
2015	CCT set up transversal management structures including the Green Economy, Energy and Climate Change (GEECC) Working Group, comprising representatives from 14 different line functions, to mainstream climate change issues across local government	Context; CAPA case study; CDS case study; stormwater case study

	CCT signs the Compact of Mayors, committing to standardised measurement of emissions and climate risk and consistent public reporting of efforts	Context
	CCT joins the 50 Municipal Climate Partnerships Programme, partnering with City of Munich in Germany to develop joint programmes of action on climate change mitigation and adaptation	Context, CAPA case study
	CCT wins C40 Adaptation Implementation Award for the Water Conservation and Demand Management Programme	Context
2016	CCT joins the 100 Resilient Cities Network, gaining access to resources to develop a roadmap to resilience for the city and establishing a new position in city government, a Chief Resilience Officer, to lead the city's resilience efforts	Context
	Local Biodiversity Strategy and Action Plan 2016-2026 finalised and adopted that integrates climate change considerations	Context
	CCT puts out tender for city-wide spatial assessment of climate risk and vulnerability, but no contract awarded due to internal procurement and funding complications	CAPA case study
	CCT puts Draft Climate Change Policy out for public participation	Context; CAPA case study; CDS case study
2017	Climate Change Policy approved by Council	Context; CAPA case study; CDS case study

10.2. Revisiting the adaptation cycle and phase model of decision making

First, I look at the fit between the three case studies of adaptation processes in Cape Town and the adaptation cycle model. As discussed in chapters 2 and 3, from reviewing the adaptation and decision making literature it becomes clear that the adaptation cycle model is one instance of the more generic phase model of decision making. The key elements of the model are depicted in figure 13, adapted from Moser and Ekstrom (2010) and UN-Habitat (2014), with additions from Teisman (2000) showing influence of external actors (purple boxes) and Park et al. (2012) differentiating between incremental cycle (shown in grey) and transformative cycle (shown in green).

Figure 13: Adaptation cycle model



Teisman's (2000) portrayal of the phase model of public policy decision making depicts a generic set of phases broadly consistent with the steps suggested in most instances of the adaptation cycle model found in the climate change literature (e.g. Moser and Ekstrom, 2010; UN-Habitat, 2014; Knieling and

Klindworth, 2016). The steps or phases broadly entail detecting and defining the problem, forming a policy and/or plan through the identification and assessment of options, implementation, evaluation and modification. One aspect of the decision-making cycle that appears in Teisman's characterisation of the model that is often missing from the adaptation versions of the model is the different types of engagements and influences that actors external to the central actor taking the decision have on the decision-making process (shown in purple call out boxes in the above figure 13). Teisman (2000) points out that the phase model assumes a central decision, deemed to be at the point of policy adoption, and a central actor that makes the decision. In the phase of policy formation, external actors are often consulted and participate in generating and sometimes selecting, or expressing a preference for, options. In the policy adoption phase external actors or social groups lobby and work to exert influence on policy-makers or politicians tasked with formally taking the decision, i.e. adopting or rejecting the policy. In the implementation phase external actors play a role in either supporting or hindering the enactment of the decision. And there may be further consultation and participation when it comes to evaluating the effects of implementation and reformulating the policy. The versions of the adaptation cycle model that appear in the climate change literature, both the academic literature and the policy and practice literature (often referred to as grey literature), are not this nuanced, saying very little of who is involved in undertaking and/or influencing the enactment of the steps or phases in the cycle, beyond emphasising the important role of local government in broad terms (Lundqvist, 2015; Boyd and Juhola, 2015; Huitema et al, 2016; Mees, 2016). Some point to the importance of stakeholder engagement and public participation, but do not distinguish between different types of engagement and influence or highlight the existence of dissenting voices from actors or stakeholders seeking to influence politicians to reject the policy or acting as a hindrance to implementation. The lack of reflecting the complexities of actor involvement in the decision-making process, disaggregating between across within local government as well as those external to local government, highlights the roots of the model in rational decision theory rather than

behaviouralist and political theories of decision making. With its origin in classical rational decision theory, the cycle model is based on an assumption that there exists good, robust uncontentious knowledge of the problem, the options and the consequences of each option and thereby a central decision maker can be charged with undertaking the steps in the cycle and selecting a course of action. The existing literature that presents climate adaptation as a wicked problem (Karl et al., 2011; Termeer et al., 2013; Vogel et al, 2016) challenges this assumption and by extension the applicability of the adaptation cycle model. Although critiquing the adaptation cycle model has not been the explicit focus and finding of previous research, hence the contribution made by this study. By applying the adaptation cycle model to the three Cape Town climate adaptation process case studies I will demonstrate that the focus on process devoid of conceptually representing the role of multiple actors and interactions and based on the assumption that there is good knowledge of the problem, the options and the consequences of each option severely limits the utility of the cycle model in making sense of processes of urban climate adaptation.

10.3. Applying the adaptation cycle model to each of the three cases

The first phase of Cape Town's CAPA process was the development of a framework for adaptation planning (i.e. what became the FAC4T document) that explicitly laid out an 8-step planning process based on the adaptation cycle model, as described in chapter 7 (section 7.2.1). The preparation of the various CAPAs then followed the first four of these steps (i.e. assess climate trends and projections, undertake vulnerability assessment, formulate strategy, develop adaptation options) but then largely stalled without completing steps five through eight of the cycle (i.e. evaluate priority adaptation options, scope and design projects, implement, monitor and evaluate). While reflecting some elements of the cycle model, the CAPA case study revealed a number of aspects of the adaptation process that are not conceptually represented in the cycle model. Firstly, the formulation of the problem requiring Cape Town to adapt, as

well as mitigate, initially and erroneously appears in the 2006 Energy and Climate Change Strategy as one of energy insecurity. The problem and primary goal of climate adaptation in Cape Town then goes on to change and be reformulated quite substantially over time, through the FAC4T framework, the two versions of the CAPA and the CTCDS, but not as a result of completing all the steps in a full adaptation cycle, as the model suggests. To the contrary, the stated need for an Energy and Climate Change Strategy surfaces in the Integrated Metropolitan Environment Policy (IMEP) in 2001, well before a clear articulation of the nature of the local problems that climate change poses for Cape Town. Secondly, the CAPA case brought to light evidence of efforts made by ERMD at 'mainstreaming' the adaptation options and plans into the core functioning of relevant line functions and departments. While ERMD could be deemed the central actor driving the CAPA process, the case study shows that progress in identify and selecting options and adopting and implementing the plans were highly dependent on the involvement of other actors. As such, the CAPA case drew attention to the variety of internal and external actors involved in the process, the ways (technical, procedural or political) in which some support and others interfere or hinder the process at various times, and the difficulties involved in coordinating between these actors. This is something the adaptation cycle model does not adequately represent. Thirdly, the adaptation cycle model provides no insight into why the CAPA process may have stalled without completing all the steps in the cycle, or what might be done to unlock progress. This is where the adaptation barriers literature (discussed in section 2.6 on adaptation as a governance challenge) has emerged to make a contribution, but without going so far as to challenge the adaptation cycle model and offer a new or revised version of an adaptation process model.

The adaptation cycle model offers almost nothing for understanding the second case study, that of climate change being integrated into the City Development Strategy as a core goal of building the city's climate resilience. It was not the detection and definition of climate change as a problem for Cape Town

that initiated the CDS process. There was no clear step in the CTCDS process involving the assessment or appraisal of various adaptation or resilience building options. There is little evidence that the adoption of the CTCDS has contributed to the implementation of such options, whether named in the CTCDS itself or those included in the pre-existing CAPAs, and no evaluation has yet been done on the implementation and/or outcomes of adopting the CTCDS. The phase model of decision making vaguely holds true in the sense that the CDS process involved phases of policy formation and policy adoption, and possibly some policy implementation through the Integrated Development Planning process, although these linkages between the CTCDS and IDP are very difficult to trace and there is no clear sign of direct CTCDS implementation. The phase model also applies in that the CDS phases entailed both lobbying from and stakeholder engagement with external actors that fuelled the process, shaped the vision and the identification of options, and the decision by Council to adopt the policy / strategy. But as mentioned earlier in this chapter, the adaptation cycle version of the phase model rarely includes these elements of actor involvement and influence.

In the case of stormwater master planning, the adaptation cycle model also provides limited use to analyse, understand and critically engage with the process. There is some descriptive power in identifying and characterising the 2004 flood event and the commissioned work of various consultants and university-based scientists as significant to the step of detecting and defining the problem in the climate adaptation cycle. However, like in the CAPA case, the cycle model does a poor job of representing the importance of other actors beyond the Stormwater and Sustainability Branch, both internal and external to the CCT local government, to the decision-making process (e.g. the formation and functioning of the Climate Change Think Tank). Similarly, the cycle model does not capture the existence of multiple parallel and intersecting processes that have a bearing on both the progress and outcomes of each process, for example the stormwater infrastructure asset management and master planning work

connecting up with the research commissioned by the Climate Change Think Tank in order to integrate both the rainfall analysis and sea level rise assessment work into the run-off and streamflow modelling of the Salt river catchment. Nor does the cycle model offer any insights into why a process stalls, as has been the case with extending the inclusion of climate change projections into the masterplans of all the city's catchments, and the reassessment every five years of the available science that underpins the decision to increase in rainfall intensity figures by 15%, as was recommended (Schulze et al., 2010) and intended (interview with CCT official, March 2015).

10.4. Composite readings of climate adaptation using the adaptation cycle model

Looking across the three cases, the fact that there was: (1) an effort to understand the climate risks and vulnerabilities as a basis for identifying adaptation options; (2) have the plans and strategy formally adopted, or at least noted, by politicians in advance and support of implementation, and; (3) an expressed intention to review and update the decisions at some later date, is evidence that the cycle / phase model is influential in designing these adaptation processes. However, as a conceptualisation of the empirically observed processes the cycle model seems a poor fit in that it inadequately captures and represents a number of important aspects that surface in the case studies. The adaptation cycle model says nothing of: the number and diversity of actors involved in undertaking various aspects of each step or phase and enabling or inhibiting progress between the phases; the temporal scale of the process; or the interactions between multiple such processes unfolding over a similar time period, all of which are clearly evident in the case studies. And the empirical cases reveal only a few of the steps in the cycle. For example, there is no clear evidence of any kind of overt screening of options, coherent implementation and/or monitoring and evaluation. In all three cases there is mention of the need to evaluate and reassess

within a particular period of time, but this has not yet happened, it is unclear who is in a position to do so, and there is little suggestion of it being a priority for the near future.

When it comes to identifying the central decision of policy adoption, i.e. the transition from formulation to implementation, as suggested by both the adaptation cycle model and the phase model of decision making, there is not one such central decision evident, despite over ten years of work on climate adaptation. Instead there are multiple decisions evident that have contributed to gradually, incrementally and partially adapting various aspects of local government functioning (including administrative, regulatory and operational aspects) in light of changing climate conditions, as summarised in table 4, provided in the introductory section of this chapter. But none of those decisions have been in and of themselves central to making climate adaptation a policy priority for the CCT. Much of the decision making pertaining to climate adaptation in the CCT has been focused on information gathering, problem formulation and reformulation, awareness raising, agenda setting and relationship building. The lack of a central decision negates the simple linear phases model. The cyclical version of the phases model can be applied, making each decision an iteration of the cycle. But the fit is not a good one because, while the activities relate to numerous model phases, they have not happened in a staged, sequential or iterative manner. Proponents of the cycle / phases model of rational decision making (Moser and Ekstrom, 2010; UKCIP, undated; NCA, 2014; UN-Habitat, 2014; Knieling and Klindworth, 2016) suggest the model is useful because it provides a structure for both organising the analysis of decisions and guiding those tasked with decision making. Based on the evidence gathered in Cape Town, I argue that the cycle or phase model is not sufficiently useful for either of these purposes, i.e. analysing or guiding climate adaptation decisions at the city scale, and therefore an alternative model is needed.

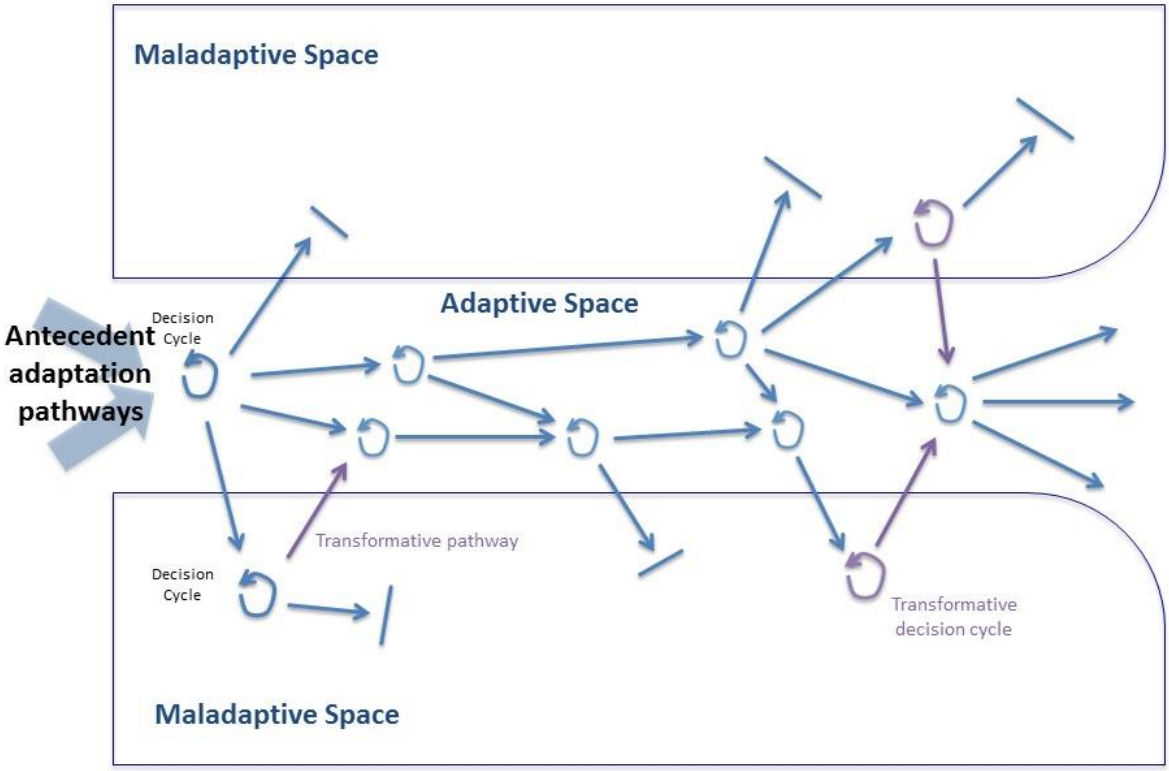
The expansion of the adaptation cycle model through a focus on learning and the distinction between incremental and transformative adaptation, primarily proposed by Park et al. (2012) and depicted in the above diagram through the inclusion of two concentric cycles (the incremental adaptation cycle shown in grey and the transformative adaptation cycle shown in green), has gone some way in augmenting the cycle model to partially account for some of the above-mentioned shortcomings. However, I argue this is insufficient as a way of dealing with temporality because it is still based on undertaking sequential steps and suggests that all steps in one need to be completed to move from an incremental cycle to a transformative cycle or the other way around. The evidence from the case studies does not support this as being the way such processes unfold in practice. Park et al. (2012) rename the adaptation decision-making process an action learning cycle, condensing effectively the same steps into four 'activity clusters' and distinguishing two interconnected cycles of incremental and transformative adaptation with the potential to move between the two cycles, particularly after completing and learning from the actions taken in all the phases of one cycle. The adaptation action cycles framework suggests that a cycle of incremental climate adaptation actions undertaken to maintain the current (urban) system can, under certain conditions, lead to a subsequent cycle of actions to transform the system into something new, and ultimately then by a cycle of incremental actions to maintain the new system. As such the concept of sequential phases is still at the core of the model. While learning from action is indeed very evident in Cape Town, as actors form new networks and try new ways of getting climate adaptation into city decision making and operations, the evidence from Cape Town does not seem to support the cyclical conceptualisation of how this learning and adaptation occurs as distinct incremental and transformative cycles made up of sequential steps or phases. Rather processes seem to start, stall and intersect in more anachronistic ways and (planned) actions that may be deemed incremental or transformative in nature seem to coexist in plans and strategies. Based on fine-grained evidence of climate adaptation decision making collected in Cape Town through embedded research, even the revised and

expanded adaptation cycle model provided by Park et al. (2012) does not sufficiently conceptualise and explain how adaptation happens in practice.

10.5. Revisiting the adaptation pathways model

Having applied and critiqued the cycle model of adaptation, I now turn to the more recent conceptualisation of the adaptation process as a set of pathways (often visualised as a route map) to be navigated. While the early work focused on the adaptation options as the branch points in a pathway (Reeder and Ranger, 2011; Haasnoot et al., 2013; Rosenzweig and Solecki, 2014), subsequent work abstracted the idea of multiple pathways as a representation of the adaptation process itself (Wise et al., 2014). Within the Wise et al. (2014) adaptation pathways model, rather than the branch points being adaptation options, they are decision cycles, each of which have one or more outcomes that lead along or create one of many possible pathways, as graphically depicted in figure 14 below (adapted from Wise et al., 2014). Each decision cycle is one in a chain of decision cycles that constitute a pathway. The pathways model of adaptation as a process thereby contains within it the cycle model but, rather than focusing on the steps or phases of the cycle, it draws attention to a broader process within which numerous cycles of decision making occur, or could occur. In effect, the pathways model gives more attention to the temporality of the process by conceptualising and representing what happens before, after and in parallel with any given decision cycle and how these influence or shape what happens within that particular decision cycle, which in turn gives direction to the pathway being taken.

Figure 14: Adaptation pathways model



The pathways model provides three primary additions or modifications to the adaption cycles model. Firstly, the pathways model introduces concepts of antecedent pathways that precede the contemporary decision cycle, or the decision cycle under study, that give rise to path dependence or historical determinism. Secondly, the model distinguishes between adaptive and maladaptive parts of the decision space, the boundaries between which shift over time as climatic, social and institutional conditions change. The set of prevailing values and institutions underpinning the distribution of power and resources within a society determine whether a given system is positioned in the adaptive or maladaptive part of the decision-making space and thereby their preparedness for undertaking adaptation. And thirdly, the notion of transformative adaptation is included as a decision cycle and subsequent pathway segment that leads out of the maladaptive space, taking the pathway back into the adaptive space. How do these conceptual developments apply to the three Cape Town case studies?

10.6. Composite reading of climate adaptation using the adaptation pathways model

The notion of antecedent pathways helps to identify the significance of preceding decision cycles in shaping the framing, initiation and involvement of other actors in a given process. In the case of the CAPA this includes, for example, the preceding Energy and Climate Change Strategy (CCT, 2006), the Integrated Metropolitan Environment Policy (CCT, 2001), and the development of the second version of the CAPA based on the perceived shortcomings or limitations of the first version. In the case of the CDS, this casts light on the relationship between the early IDP processes, limited by electoral cycles and narrow public participation, the OECD territorial review study (OECD, 2008), and the need for a more strategic visioning process with a longer time horizon and both wider and deeper stakeholder engagement. Similarly in the stormwater case study, the antecedent pathways enable an analysis of the adaptation process to identify the connections between a series of decisions, including creating an asset register, forming the Climate Change Think Tank, researching long-term rainfall and streamflow patterns (both historical and future projections) and adopting new stormwater management policies, that led to the revision of the Salt River masterplan based on the inclusion of both a Climate Change Factor of increased rainfall intensity and sea-level rise projections.

Applying the model's concepts of adaptive and maladaptive parts of the decision space and institutional preparedness of a decision-making or governance system to the cases potentially gives rise to a new insight. The fact that all three processes studied in the research stalled in various ways, particularly with regards to limited or partial implementation and no systemic monitoring and evaluation as a basis for organisational learning, may be considered evidence of the CCT still being positioned in the maladaptive space, even after ten years of adaptation efforts. This in turn suggests that only undertaking incremental adaptation is insufficient for addressing the climate risks and vulnerabilities faced in Cape Town. Moreover, the application of the model suggests that transformational adaptation is required to

change the urban system of Cape Town, and the wider governance system that it is part of, into one that is able to detect change, experiment, learn and adapt more effectively in the face of changes in the climate system. While the application of the pathways model helps to identify the need for transformational adaptation, both in terms of how decision are taken (i.e. the decision cycle) and what options are selected (i.e. the decision pathway), it offers little insight into what changing the prevailing values, institutions and governance arrangements underpinning the distribution of power and resources within a society this might entail.

Despite the additional conceptual tools that the pathways model offers in understanding the adaptation processes observed in Cape Town, it still does not adequately capture and represent some empirical findings from the Cape Town case studies, many of which resonate with similar findings reported in the adaptation governance literature (notably Biesbroek et al., 2014b; Huitema et al., 2016; Termeer et al., 2016). These include:

1. the relationship and forms of coordination between the political and administrative parts of the local government (e.g. the implications for the CAPA process of the formation of the GEECC Working Group and for the CTCDS process of the Strategic Policy Unit);
2. the influences and forms of coordination between different decision-making levels and territorial scales in the governance system (e.g. the subsidiarity of the CTCDS to the OneCape 2040 strategy affecting the vision and timing of the CCT's decision, and the role of the Western Cape Provincial Climate Change Response Strategy and climate change forum in influencing the actions taken by the Stormwater and Sustainability Branch);
3. the interface between research (undertaken within both public and private entities) and decision making, or between science and policy (e.g. the use of consulting companies and academics to

develop the FAC4T, the CAPA, the CTCDS, the stormwater asset register, and the rainfall, streamflow, sea-level rise, coastal overtopping and flood routing analyses);

4. and the various types of governance choices that adaptation entails (e.g. the selection, timing, implementation, enforcement and evaluation of the instruments or mechanisms included in or excluded from the CAPAs, CTCDS and stormwater masterplan).

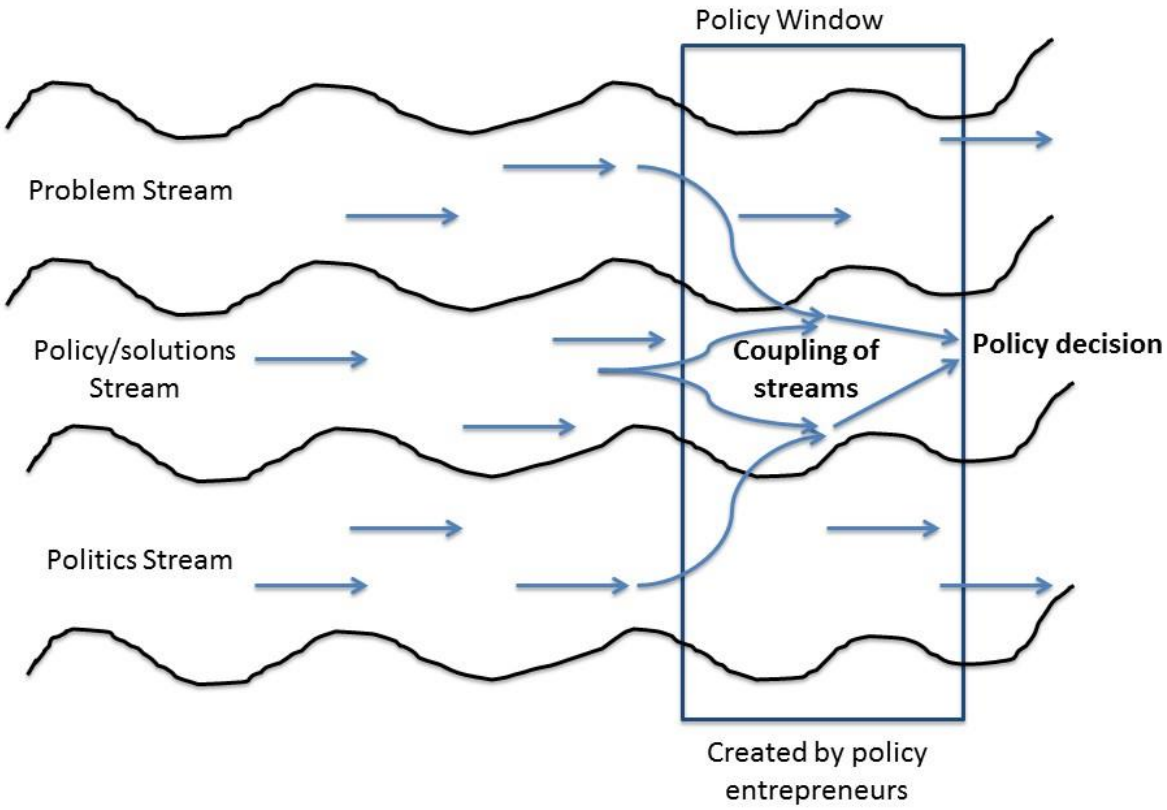
To see if it is possible to accommodate these important omissions, I now turn to the streams and rounds models of decision making to see if they provide any additional conceptual tools for making sense of these elements of the case studies and to further develop the theory of urban climate adaptation as a process.

10.7. Revisiting the streams model of decision making

The streams model of decision making, developed by Kingdon (1984) out of the original garbage can model proposed by Cohen et al. (1972), departs quite considerably from the cycle / phase model in two key respects. Firstly, decision making is no longer viewed in association with one central decision maker (with varying levels of participation by other external actors). Rather decisions are conceived of as emerging from the actions and influences of multiple actors. Secondly, decision making is no longer viewed as a temporal sequence, but instead as actors acting simultaneously on various aspects of a decision that, under certain circumstances, coalesce or link up to give rise to a policy decision. This is postulated to explain the unpredictable and dynamic nature of decision processes, and thereby the lack of any regular pattern in observed data. The simultaneously co-existing aspects of a decision-making process are conceptualised as three streams, one consisting of problems being prioritised by various actors, one of solutions (i.e. measures, interventions or policy instruments) variously favoured by different

actors, and a third stream representing political currency based on influential interests and/or popularity. It is when a particular set of problems, solutions and political commitments are successfully coupled that a decision is achieved. Within the model, these moments of coupling are called policy windows and those who play a key role in making the linkages are identified as policy entrepreneurs. The key elements of the model are depicted in figure 15 below, adapted from Teisman (2000) and Jones et al. (2016) showing three co-evolving streams that are coupled when a policy window opens, often through tactics by policy entrepreneurs, to result in a policy decision.

Figure 15: Streams model of decision making



10.8. Composite reading of climate adaptation using the streams model

In the CAPA case, the decision to develop and adopt a set of sectoral climate adaptation plans could be seen as the coupling between the problem of climate risks and impacts facing Cape Town, the solution of numerous local government departments taking charge of planning, funding and implementing suitable adaptation measures that fall within their remit, and the politics of international climate change negotiations, lobbying by local environmental interest groups and experts, and the environment department looking to have its priorities more strongly reflected in the functioning of Cape Town's local government as a whole. The policy entrepreneur was a senior manager in the environment department and a policy window was partially opened through securing funding, cultivating inter-personal networks across departments, and climate change gaining attention in the media and in policy circles internationally. Moreover, it could also be deduced from applying this model that the policy window was never fully opened and the coupling of streams established, such that the CAPA process stalled and has not reached fruition, which is why many of the steps or phases are not evident. This may in part be explained by the CCT politicians and executive management perceiving climate change as an environmental concern in a time when economic development was the political priority and consequently adaptation did not draw sufficient attention by decision makers.

Applying the streams model to the CDS case study gives rise to a view that the CTCDS emerged when the problem of short-term election cycles and limited public participation undermining long-term city-wide planning linked with the solution of a 30-year multi-stakeholder visioning exercise. These in turn linked to a political context of competitiveness between South Africa's metropolitan municipalities, the Democratic Alliance was gaining ground in both Cape Town's local and provincial government, favouring public-private partnerships, ideas of the entrepreneurial and world-class city, and a client or customer oriented public service, and UN-Habitat and Cities Alliance was globally promoting the CDS as a tool for

good urban governance. The policy window for Cape Town's CDS opened due to a combination of the findings of an OECD territorial review study (OECD, 2008), lobbying from within and outside of the local government, the parallel development of a provincial vision and development strategy for the Western Cape, the formation of the Economic Development Partnership, and the joining of the CCT and Provincial processes into the OneCape 2040. Important policy entrepreneurs in the process included members of the CCT's SPUD department, the Strategic Information Branch, the EDP and UCT's ACC. The climate change problem was coupled with the long-term planning problem and the goal of building climate resilience was incorporated into the 30-year vision and strategic plan for Cape Town because: of the work that had already gone into developing the CAPAs, including ERMD collaborating with SPUD to look at adaptation needs and options for Cape Town relating to spatial and urban planning; a growing number of Cape Town based non-government organisations working on issues of climate change were consulted in the CTCDS process; and internationally there was growing attention being given to climate resilience in cities (led by the C40 network). The evolution of the political stream subsequent to the Council's adoption of the CTCDS is marked by the handing over of the custodianship of the CTCDS from the SIB to the CCT's newly formed Strategic Policy Unit and a shift in focus from implementing the CTCDS to developing an Economic Growth Strategy and a Social Development Strategy that saw the CTCDS process somewhat stalling. The streams model helps make sense of these interconnections and temporal evolution of the CAPA and CDS processes in a way that neither the cycle / phase model nor the pathways model do.

In the case of integrating climate change projections into stormwater management, the streams model sharpens the analytical focus on how the problem of flooding and deteriorating water quality was coupled with the problem of climate change and more specifically local changes in rainfall and sea levels. The solutions being pursued by the Stormwater and Sustainability Branch through master planning, catchment management, ecological rehabilitation and protection, and controlling property development,

under the banners of risk management and sustainability, were coupled with climate adaptation solutions requiring a forward-looking approach that recognised the statistical non-stationarity of local rainfall and sea level patterns and the implications for stream flows, coastal overtopping and flood characteristics. Senior managers in the CCT's stormwater and environment units played the role of policy entrepreneurs. There was strong involvement of research scientists and consulting engineers in generating the evidence-base for the decisions. There was very little involvement by politicians in the decisions to include a Climate Change Factor in the gridded rainfall data to be used in the catchment modelling and development of masterplans. This lack of political involvement may have enabled technical and administrative progress to be made in the short-term, but may be part of the reason why the full implementation of the decision has stalled due to a lack of budget allocation to complete the modelling and master planning of the remaining catchments. Also, subsequent concerns and objections raised by developers over the inclusion of a Climate Change Factor may yet jeopardise the decision, especially in a political climate favouring development for the purposes of job creation and municipal revenue generation over sustainability and adaptation concerns.

In sum, the streams model of decision making helps to account for the seemingly more dynamic, temporally irregular and tactical nature of the climate adaptation process unfolding in Cape Town, much more so than the patterns of temporal sequencing proposed by the cycle / phase model and to a large extent the pathways model too. The streams model brings into view the work of multiple actors and the competition between multiple issues or problems and multiple potential solutions or interventions that are all simultaneously, yet to varying degrees, influencing the direction of city-wide decision making. It enables the analyst to identify how, in Cape Town, the problem of climate risks and impacts facing Cape Town exists together with a plethora of other problems, e.g. unemployment, informal housing and settlements, electricity shortages, water pollution, population growth, spatial segregation, poor health,

biodiversity loss, air pollution and the list goes on, all vying for political attention. Application of the streams model sheds light on how climate adaptation comes into competition with, or is linked to, solutions that address other problems and how this in turn influences the extent to which it receives attention within the decision-making space of the city government.

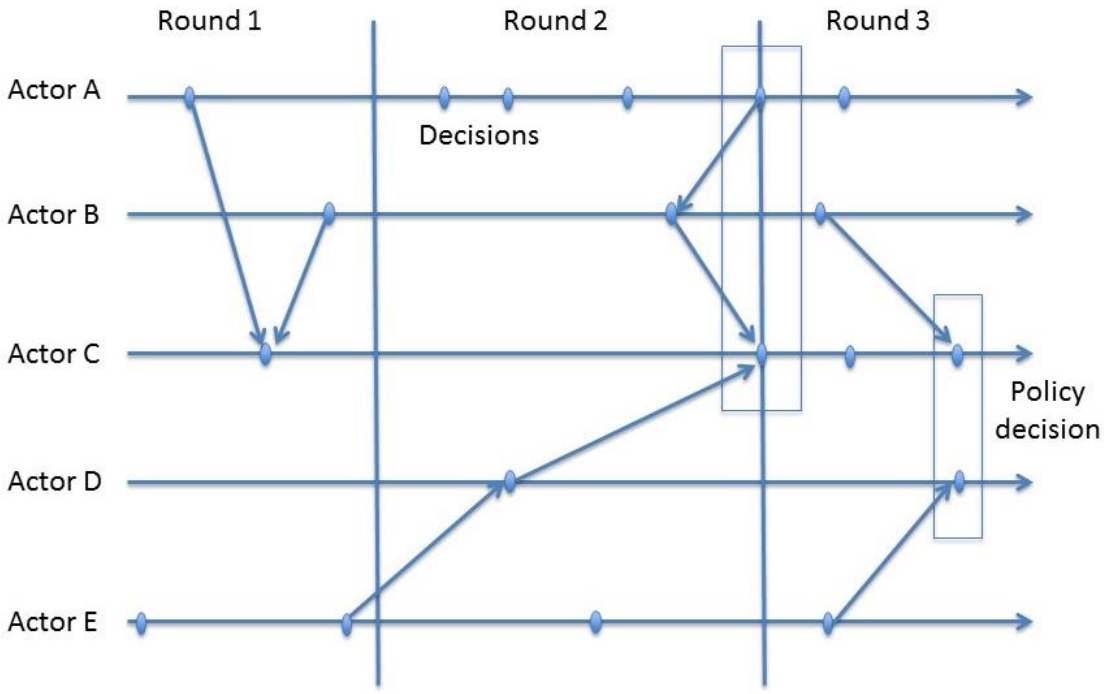
The streams model makes legible how numerous actors and groupings of actors within local government, together with actors in higher levels of government, academia, civil society and the private sector, have all been working, to varying degrees, on aspects of climate adaptation. Some, at times, have been oblivious to the work of others, others in communication and support of one another, and other yet in competition and hindrance of each other. On the whole there has been no consistent coordination around the issue of climate adaptation across local government. It is at times when streams have coincidentally intersected, or opportunistically been brought together, that progress has been made. For example, the creation of the CTCDS provided an opportunity for ERMD staff to work with urban planners and information specialists to articulate and raise the profile of the climate change problem and climate adaptation as one important solution by making it part of the future vision for Cape Town, leveraging the attractiveness and integrative power of the urban resilience concept that was fresh and new on the international policy scene at the time. The formation of the Climate Change Think Tank is another example of the three streams coming together in productive ways. It enabled ERMD, the Stormwater and Sustainability Branch and numerous academics and consultants, with dedicated resources to create the time and space to collaborate, to coordinate and further develop their respective work on sea-level rise, stormwater master-planning, climate modelling, hydrological modelling and coastal engineering, generating new insights into the local nature of coastal and inland flooding in Cape Town under scenarios of future climate change. The streams model thereby helps to explain why multiple decisions are evident

and yet do not display the sequential temporal pattern that is core to the cycle / phase model and to a large extent the pathways model too.

10.9. Revisiting the rounds model of decision making

The rounds model places more primacy on the multiple actors involved in decision making. Instead of three streams of problems, solutions and politics, the rounds model conceptualises each actor making sequences of decisions over time. Policy decisions are postulated to result from the interactions between the decisions of numerous actors, both via a preceding decision influencing a subsequent decision and an anticipated future decision influencing a contemporary decision, whether the two decisions are made by the same or another actor. As such, the rounds model draws more attention than the preceding models to how the three case studies should be viewed not as separate, stand-alone processes of adaptation, but rather as elements of a larger process of city government decision making in which the sequencing is of significance. The focus on a larger, aggregate emergent process is similar to that of the pathways model. While drawing attention to the interactive and political nature of decision making, akin to the streams model, the importance placed on the sequence of decision sets the rounds model apart from the largely independent coexistence and coincidental coupling proposed by the streams model. Yet the multiplicity of the decision chains being sequenced also distinguishes it from the cycle / phase model. The key elements of the rounds model are depicted in figure 16 below, adapted from Teisman (2000), that draws attention to the interactions between the decisions taken by multiple actors, giving rise to larger policy decisions.

Figure 16: The rounds model of decision making



The rounds model brings into view not only the involvement of multiple actors in urban climate adaptation decision making but highlights how the interactions between these actors shape the course of decision making. The model draws attention to: how each actor perceived and formulated the problem of urban climate impacts and the preferred solutions differently; how each actor made decisions internally while also interacting and negotiating with other actors to garner support for their decisions and to influence other decisions; and how each decision built off many other preceding decisions. The model helps make sense of the protracted and complex nature of urban climate adaptation decision making by identifying how conflicting or contradicting formulations of and prioritisation between problems (and thereby solutions) undermined the ability of actors to coordinate and cooperate, and how finding acceptable combinations of problems and solutions led to progress.

10.10. Composite reading of climate adaptation using the rounds model

Applying the model to the three cases of adaptation decision making in Cape Town necessitates a move beyond looking at each of the cases as separate decision-making processes by drawing attention to the temporal interactions between the various actors involved in different ways across all of the cases and how the decisions they take periodically interact with those taken by others. The model suggests that it is through these interactions that new policy directions emerge. As mentioned previously, this is a radical departure from the view perpetuated by the cycle model, which is based on an assumption that there is one central actor driving the process and making the decisions. By reading across the three cases it is possible to distinguish between two rounds of decision making within the CCT that have shaped the emergence and organisational embedding of the urban climate adaptation agenda.

The first round can be seen as spanning the mid-2000s to 2011, characterised by actors working largely in parallel with limited interaction on the issue of climate adaptation but each laying important groundwork to create the reasons and opportunities to interact and connect. For example, ERMD were driving the development of the CAPAs and the ECAP, DRMC were developing multi-hazard disaster risk management plans, the SPUD department were pushing the creation of a CDS to tackle long-term issues in a future oriented way, the Stormwater and Sustainability Branch were questioning and investigating patterns of rainfall intensity and the incidence of flooding and developing a framework for infrastructure asset management that required comprehensive high-level master planning. All of these activities were surfacing questions relating to the local dimensions of climate change and how to address them, but effectively each actor (i.e. organisational unit) was making their own decisions about what to do. These activities and decisions then began to interact and coalesce in a number of ways around 2011, which could mark the end of a first round of urban climate adaptation decision making within the CCT. Instrumental to these interactions were the formation of the Climate Change Think Tank, the attention given to climate

change due to South Africa hosting the UNFCCC COP17 event, and the consultative process undertaken to develop the CTCDS. This in turn marks the beginning of a second round of decision making that is more strategic, cross-cutting and integrative in nature.

The second round is characterised by increasing efforts to elevate climate adaptation ambitions and measures beyond operational sector-based plans and into strategic guiding frameworks, notably the IDP, the SDF, the zoning scheme and drafting a Climate Change Policy (CCT, 2017) that positions climate adaptation as a key priority, alongside mitigation, across all city government decision making, i.e. economic, social, infrastructural, financial and environmental. During this second round there is also a dramatic increase in the number of international agreements and networks Cape Town's local government is party to, including the Durban Adaptation Charter, the C40 Climate Leadership Group, the Compact of Mayors, and the 100 Resilient Cities network. This is likely to play a role in increasing the political currency of the climate change agenda and thereby build a more conducive organisational environment for aligning and linking the political, technical and administrative decision-making processes within local government around issues of urban climate adaptation. However, with the focus on strategic and integrative efforts in round two, many of the sector specific planning processes initiated in round one stalled. The incomplete CAPAs were not completed and the finalised CAPAs were not monitored and revisited. The high-level masterplans for the remaining catchments were not completed. And there was been no clear, discernible progress made on many of the climate related measures put forward in the CTCDS, like setting up a Climate Change Fund for Cape Town or establishing a climate-oriented public works programme.

The practical question we are left with in the case of Cape Town is what it will take for a third round to emerge that will bring together the progress made in each of the first two rounds such that urban

climate adaptation is firmly established as a strategic priority of Cape Town's city government and implementation moves ahead in the specialist, technical domains, supported by a conducive policy and financial framework. Conceptually, the rounds model suggests that investing in the interaction between actors is what is needed. This aligns strongly with recommendations coming out of the governance literature for a shift towards more collaborative and networked forms of governance arrangements and away from the old hierarchies of centralised decision-making power. This would suggest that an important characteristic of policy entrepreneurs, as identified in the streams model, is the ability to create connections and build bridges between different actors, sectors, domains and disciplines. This lies at the heart of tackling complex issues and wicked problems at the nexus of climate change and urbanisation.

In sum, the evidence gathered on climate adaptation decision making in Cape Town supports the premise of Teisman's (2000) rounds model that many types of policy decisions, including that of climate adaptation, do not appear as a key moment in time but rather as long periods made up of rounds of decision making, and that the implementation of such decisions similarly hinge on many rounds of decision making. While seven of the CAPAs, the CTCDS and the inclusion of the Climate Change Factor in rainfall data used for stormwater planning were all adopted as decisions, the implementation thereof all remain partial and incomplete because of being contingent on the subsequent decisions (to allocate resources, to take particular actions, etc.) of multiple actors. But ultimately all of these rounds of decision making laid important groundwork for consolidating a negotiated combination of climate-related problems and solutions into a Climate Change Policy (CCT, 2017), requiring many consultations and interactions, that is currently under formal review and public participation. As such, the rounds model shows considerable promise as a conceptual device for better understanding and possibly ultimately guiding climate adaptation processes in cities. It can be used to further develop and enrich the adaptation pathways framework, moving away from the rationalist underpinnings of the adaptation cycle model.

10.11. Theoretical development of urban adaptation as a decision making process

What is evident from applying the four models found in the adaptation and decision-making literature to the three Cape Town case studies, as summarised in table 5 below, is that Cape Town's adaptation processes do not play out as a cyclical sequence of steps or phases, let alone as cycles distinguishable as being purely incremental or purely transformative in nature. Rather than being a singular logical progression guided by a central actor giving rise to a discernible central decision, the process of adapting Cape Town to changing climate conditions is more multiplex, contested and political in nature, intersecting with a range of other ongoing decision-making processes. While the streams model helps to articulate these characteristics, it gives insufficient attention to the temporal nature of the adaptation process, placing too much conceptual emphasis on the independence and simultaneousness of the three streams, a weakness that the rounds model addresses. And so it is that a hybrid of the adaptation pathways model and the rounds model of decision making is proposed as being a more robust conceptual framework with which to understand how climate adaptation has been happening in Cape Town and thereby potentially elsewhere too.

Table 5: Summary table showing how the key conceptual elements of each of the four models map on to the Cape Town case studies

Conceptual model	Key elements of each model	CAPA case study	CDS case study	Stormwater case study
Adaptation cycle	Sequential steps or phases	Guided by 8-step planning process proposed in FAC4T but many steps not yet undertaken	Did not involve the steps of the adaptation model, not driven by climate change concerns	Evidence of opportunistic and strategic linking and leveraging of various strands of work rather than sequential steps
	Starts with problem detection and definition	First articulation of the problem in the Energy and Climate Change Strategy as primarily one of energy insecurity	Starts with visioning future city	2004 flood triggers problem detection and further research into problem definition
	Ends with evaluation and modification	Process stalled, no monitoring framework in place	Intended but not yet achieved	Intended but not yet achieved
	Central actor	Led by ERMD but heavily dependent on many other actors	Moved between the SIB, EDP, SPU and Council, so no one central actor	Stormwater and Sustainability Branch key driver but reliant on inputs from other actors
	Central decision at point of adoption	Some sectoral plans adopted while others not and varying levels of implementation challenge centrality of adoption	Adopted by Council but rapidly overshadowed by other strategies resulting in minimal implementation	Politicians not involved in decision to include a climate change factor and decision not yet comprehensively applied
	Separate incremental and transformative cycles	No clear evidence to support this distinction, a mix of incremental and transformative measures in plans	Aimed at being transformative with notion of 'game changers' but little to show for it	Decision to include projections has transformative potential but only incremental application
Adaptation pathways	Antecedent pathways	Formulation and adoption of IMEP (2001) leading to Energy and Climate Change Strategy (2006), to CAPA v1 (2009), to sectoral CAPAs (2011)	IDP limitations and OECD territorial review study (2008) leading to CDS process	Stormwater infrastructure asset register (2006) and Climate Change Think Tank (2011) leading to Salt River masterplan including climate and SLR projections
	Adaptive and maladaptive parts of the decision space	All three processes stalled with limited implementation and no systemic monitoring and evaluation as a basis for organisational learning suggesting Cape Town's local government is still maladaptive, despite over ten years of adaptation efforts, and that transformational adaptation is required		
	Transformative decision cycle and pathway	Identifies need for transformational adaptation, both in terms of how decision are taken and what options are selected, to get Cape Town into adaptive decision-making space		

Decision making streams	Importance of multiple actors	ERMD, academic consultants, other sectoral departments, portfolio committees	OECD, UN-Habitat, Cities Alliance, SPUD, SIB, process consultants, multiple external stakeholders consulted, SPU, EDP	Stormwater and Sustainability Branch, ERMD, academics, consultants, provincial government
	Problems stream	Climate risks and impacts facing Cape Town	Short-term election cycles and limited public participation undermining long-term city-wide planning	Flooding and deteriorating water quality
	Solutions stream	Sector specific, adaptation measures identified by relevant departments	30-year multi-stakeholder visioning exercise to create a DDS	Master planning, revised figures for engineering calculations, ecological buffers
	Politics stream	International climate change negotiations, commitments and alliances; personal politics within and between city govt. departments	DA increasing lead in local and provincial government; CPT as world-class city; guidance from international agencies	Minimal politics, all highly technical, stormwater not got high-level interest or attention
	Policy windows (in which streams coupled and policy decision achieved)	Partially opened through securing funding, cultivating inter-personal networks across departments, SA hosting COP14	Lobbying on multiple fronts; formation of EDP between CCT and provincial government; parallel OneCape 2040 process	Formation of Climate Change Think Tank; funding for Salt River masterplan development
	Policy entrepreneurs	Senior manager in ERMD	City manager then head of EDP; senior manager in SPUD; external lobby	Senior managers in Stormwater Branch and ERMD
Decision making rounds	Round 1	Mid-2000s to 2011, departments initially working largely in parallel, e.g. ERMD driving CAPAs and ECAP, DRMC developing multi-hazard disaster risk management plans, SPUD pushing for CDS, Stormwater and Sustainability Branch investigating patterns of rainfall intensity and the incidence of flooding and developing a framework for infrastructure asset management; round culminates in formation of the Climate Change Think Tank, the attention given to climate change due to South Africa hosting the UNFCCC COP17 event, and the consultative process undertaken to develop the CDS		
	Round 2	2012 to present, increasing efforts to elevate climate adaptation ambitions and measures beyond operational sector-based plans and into strategic guiding frameworks, e.g. IDP, SDF, zoning scheme and draft Climate Change Policy; but many of the sector specific planning processes initiated in round one stalled and implementation not being monitored		
	Round 3	Next round needs to connect up progress made in each of the first two rounds to firmly establish urban climate adaptation as both a strategic and operational priority within the CCT; requires investing in collaborative and networked governance arrangements with individuals in bridging roles		

The aspects of most analytical value in the pathways models appear to be the concepts of multiple decision points (depicted as multiple decision cycles) occurring through time, antecedent pathways, path dependencies, distinguishing adaptive and maladaptive parts of the decision space, and transformative decision points and pathway segments that are required to move out of the maladaptive space. The shortcomings, however, are that the decision points are depicted as cycles, which have shown in the Cape Town cases to be a poor proxy for the evolution of decisions, and that the tree-like route map of the pathways model suggests a limited number of antecedent pathways branching out into an increasing number of future, prospective pathways. In so doing it under-represents the complex decision context within which adaptation is playing out and gives insufficient attention to the multitude and diversity of actors and how they influence each decision point. The added value offered by the rounds model is drawing attention to the multiple actors operating simultaneously making numerous decisions through time, each with their own understanding of, interest in and preference for particular problems and solutions, and that the inter-linkages between these decisions are not only forward temporal linkages (i.e. a preceding decision affects a subsequent decision) but also backward temporal linkages (i.e. the prospect of a future decision can influence a preceding decision) and linkages between the decision made by different actors, giving rise to the notion of rounds of decisions. Therefore, my proposition is to further develop the adaptation pathways model by removing the cycles reference altogether and replacing the suggestion of a tree-like proliferation of branches over time by balancing the focus on the temporal evolution of decisions with that of the co-existence of multiple decisions being made by different actors that have a bearing on each other. The temporal progression is thereby analysed by distinguishing rounds of decisions being made that give rise to an emergent pathway, rather than discrete decision cycles that cumulatively determine the trajectory of a city's adaptation pathway.

The three decision-making processes investigated in this study, when read together using four conceptual models proposed in the climate adaptation and decision-making bodies of literature, give rise to a number of findings relating to the current theorisation of urban climate adaptation:

1. There has been a need, and various efforts, to reframe the climate change adaptation agenda from an environmental issue to a development issue and thereby shift or redistribute leadership from the environment department within local government to other organisational units, line functions, political bodies, as well as to non-state actors. This has had some successes but is far from complete in the case of Cape Town.
2. There is an ongoing tension between the fragmentation or disaggregation of the climate adaptation agenda in order to mainstream it into the existing organisational design of local government and the consolidation and integration of climate adaptation efforts into a strategic approach at the city scale to prioritise, sequence and reassess interventions between sectors, organisations, socio-economic groups, and across locations and spatial scales.
3. There are weak organisational measures for internal collaboration and coordination within the local government and weaker yet for external coordination and collaboration with governance actors in the private sector, civil society and higher levels of government. This lack of convening power constrains both the sharing and development of knowledge to guide climate adaptation, the leveraging of resources, and the pooling of expertise to design and implement suitable interventions. This observation is not unique to climate adaptation and has been identified in many fields. However, it is seen to be particularly problematic for furthering a city-wide climate adaptation agenda and programme of work. Policy and plans alone are insufficient to sustain momentum, action and learning on adapting the city to a changing climate. Rather, as the governance literature highlights and the rounds model of decision making conceptually represents, it is the diversity and quality of relationships that matter.

4. Issues of informality, inequality and social justice implicitly underpin much of the climate adaptation thinking and decision making in a city of the Global South such as Cape Town, while at the same time not featuring explicitly in any clear way. This is because it is such a core part of the development challenges facing the city government and yet it cannot be fully rendered in the technical domain. It appears that climate adaptation is often too political for the technicians and too technical for the politicians.
5. Methodologically, there is value in getting close to, and spending considerable time doing in-depth fieldwork with, the actors involved in shaping climate adaptation in a given context, if the aim is to understand how it works. The complexity and contested nature of the climate adaptation process, or rather multiple interacting climate adaptation processes, means that a survey or brief set of interviews can too easily miss important aspects or information needed to build such an understanding.

Reflecting on these findings in light of the adaptation literature reviewed in chapter 2, the issues of (re)framing, mainstreaming and weak coordination have also been encountered and identified in cities of the Global North. This suggests that the distinction between cities of the Global North and Global South in terms of climate adaptation processes and challenges may not be as sharp as envisaged at the outset of this study; at least not from an organisational perspective focussed on city governments. However, it also acts as a reminder that, as noted in section 4.3, Cape Town presents some characteristics that sets it apart from many other South African cities and cities of the Global South, which need to be accounted for when generalising case study findings and drawing conclusions.

10.12. Conclusion

Using the insights gained from ethnographic engagement and case study research in Cape Town, this chapter compares various decision-making processes featuring climate adaptation to highlight the current shortcomings of both the cycles and pathways models in conceptualizing how the urban climate adaptation process unfolds. It is proposed that urban climate adaptation is not usefully understood as one central decision made by one central actor sequentially undertaking a series of steps or phases through which the problem can be clearly defined and a full set of options rationally assessed, prioritised and implemented. To the contrary, the evidence from Cape Town shows that in practice urban climate adaptation involves a multiplicity of actors undertaking activities and making decisions that contribute to an emergent policy agenda. It is when such parallel processes are linked up that progress is made. The rounds model, when applied to knowledge generated though conducting embedded research over an extended period alongside practitioners and decision makers in local government working on multiple processes involving climate adaptation, provides useful conceptual tools for recognizing and working with this complexity. These conceptual tools can be used to further develop and enhance the adaptation pathways model. Undertaking comparative analyses between climate adaptation process cases in cities spanning the Global South and North could be a valuable next step in testing the adjusted pathways model and in critically examining the distinctiveness of governing climate adaptation in various urban contexts.

Chapter 11: Conclusion

In the previous pages, I brought to light how four conceptual models offer different strengths and weaknesses for making sense of the evidence on climate adaptation decision making gathered in Cape Town. In this concluding chapter I revisit the aim and research questions underpinning this study to reflect of the significance and implications of the findings discussed in the preceding chapter.

This study aimed to interrogate how city governments undertake urban climate adaptation. This required addressing three sub-questions:

1. What evidence is there of climate adaptation happening in a city and how can such evidence be collected and analysed?
2. Who or what is involved in progressing and/or inhibiting climate adaptation from happening at the city scale, and in what way?
3. What is the temporality of climate adaptation occurring at the city scale?

In addressing these questions, the findings from this study are that there is a wealth of evidence of climate adaptation happening in a city such as Cape Town. But to go beyond high-level, aspirational messages of what local governments say they want to and will do, which often does not align with what it actually is doing, requires getting up close with people, internal documents and processes that are often difficult to access from outside the organisation. Doing the kind of organisational ethnographic work that embedded research entails, as undertaken in this study and described in the methodology chapter, makes this possible. Having applied this methodology, together with that of processual case study research, the Cape Town case studies have revealed that there are many actors involved in and indeed central to progressing urban climate adaptation, both inside and outside of local government, to the point that it

seems counter-productive to think about there being one central actor responsible for and able to drive the urban climate adaptation agenda, let alone the urban climate agenda as a whole (i.e. including linkages with climate change mitigation). Each of the three case studies of decision-making processes that involved furthering the climate adaptation agenda in Cape Town were led by different units within the city government's administration. While decisions were taken, or at least noted, by political bodies within the city government, these were mostly a formality. This lack of political involvement may well be a contributing factor to the difficulties encountered with progressing the climate adaptation agenda in an integrated and consistent way. The involvement of consultants commissioned by the city government was found to be critical to making all three of the processes possible and to be influential in shaping the content and the process undertaken. The range of actors involved in different ways at different times in the urban climate adaptation process highlights the significant investments needed in coordination and collaboration to enable a strategic and forward-looking approach to urban climate adaptation, especially if it is to move beyond the realm of incremental adjustments to more transformational types of change.

The question of temporality has not been dealt with much in the existing climate adaptation research and literature, other than broad statements around the mismatch between the long temporal scales that changes in the climate play out at and the short temporal scales of policy and planning cycles. The evidence gathered in Cape Town supports this claim, but goes further by finding that the temporal nature of the aggregate urban climate adaptation process extends well beyond the one to five year planning and policy cycles of local government in South Africa. Rather urban climate adaptation seems to progress in fits and starts, often through connections made between decision-making processes, displaying a longer and more syncopated character than might be expected. The case study evidence suggests that this may be because climate adaptation does not fit into the planning and policy processes of one central actor but is rather by its nature distributed amongst numerous actors and thereby emerges

out of many decisions, some of which impact directly on each other but others of which are quite disparate.

The implications of these findings theoretically suggest that the adaptation cycles model is a poor proxy for how urban climate adaptation actually is undertaken, which calls into question whether it should feature so extensively in adaptation guidance circulating internationally and nationally. The adaptation pathways model offers more in the way of conceptual tools to understand and guide climate adaptation in cities, but has some current weaknesses that could be strengthened by drawing conceptual resources from the rounds model of decision making. The rounds model of decision making builds off the streams model of decision making, thereby capturing the interactive and political nature of complex decision making in which many actors are involved, in addition to the more technical and administrative aspects of planning, albeit strategic planning. What the application of the rounds model helps to surface and make clear from the empirical evidence is that implementing urban climate adaptation requires effectively and repeatedly over time linking between the operational planning, strategic planning and policy-making decision made within city government. This in addition to linking with other governance actors operating at various territorial levels, as is emphasised in much of the existing governance literature. Making such linkages across the technical, administrative and political parts of a city government, regularly and repeatedly, requires structures, processes and individuals equipped and empowered to do so. Yet very few such structures, processes and individuals exist, which significantly constrains the realisation of urban climate adaptation outcomes.

Methodologically, the implications of the study are that the combined use of ethnographic and case study methods and embedded research arrangements of working closely with and within the organisations undertaking urban climate adaptation can be considered a valuable and necessary approach

for better understanding what climate adaptation entails in practice and thereby derive conceptual insights for how climate adaptation might be designed and supported in other cities.

From a policy and practice perspective, the implications of the study are that progress in adapting cities to a changing climate is currently constrained by the problems and the solutions being too technical for most politicians to deal with and prioritise and too political for most technical and administrative officials to design and implement. The focus of promoting and supporting urban climate adaptation should therefore not be placed on one central actor completing the steps or phases in a planning and policy cycle, but rather on mediating and coordinating between the many actors, across the political, administrative, technical and scientific spectrum, as well as the public, private and civil society spheres, that play an influential role in shaping what is inevitably an emergent set of climate adaptation pathways for a city. This is as important as the multi-level aspects of coordinating between different territorial scales of decision making that much of the current governance literature promotes. The temporal aspect of this study highlights that the urban climate adaptation process is one that occurs over decadal time scales. This challenges current models of funding and organisational design, which will need to be rethought if climate adaptation at the city scale is to be achieved.

The climate, history, socio-economic profile and governance network of Cape Town may be somewhat different to other cities in South Africa and beyond, but a number of lessons emerging from Cape Town's experience to-date can potentially shed light on the challenges and opportunities for addressing climate and development challenges in cities elsewhere. Firstly, understanding the spatial, social and ecological configuration of climate change hazards, vulnerabilities and risks is key to planning interventions and prioritising investments. Building such an understanding requires inputs from people operating in a variety of organisations, sectors and disciplines. Secondly, the climate change agenda

cannot be framed simply as an environmental issue to be dealt with by the local government's environment department. Rather, it needs to be elevated to a multi-sectoral, cross-cutting issue, requiring contributions from numerous line functions and specialist units and coordination across and between the strategic and operational levels of local government. Thirdly, collaborations, partnerships and networks at the city, national and international scales, are critical to tackling the large, complex and interconnected challenges and opportunities posed by climate change and development. Additionally, developing more effective and sustained forms of engagement and collaboration between government, the private sector and civil society groups is essential for an inclusive and socially just approach to furthering city development while tackling climate change. As demonstrated in the three case studies, initiating such work takes considerable time, creativity, foresight, energy, resources and social capital. This requires sustained investment, supportive policy, legislative and financial frameworks, and skilled individuals.

By casting light on the inner workings of local government through undertaking embedded research and deploying methods of organisational ethnography and processual case research, this study has found that the process of urban climate adaptation looks in practice quite different from what the dominant conceptual models of climate adaptation suggest. The notion of sequential steps or phases guided by a central actor to complete an adaptation cycle, underpinned by rational choice theory, is often influential in designing urban adaptation processes. Yet, what actually plays out in practice looks decidedly different. Instead of a central actor guiding the process, urban climate adaptation is instead contingent on the actions and decisions of numerous actors with technical, administrative or political mandates that relate to climate adaptation in various ways. Many of the steps do not unfold in the sequence suggested by the cycle model. Steps or whole processes get stalled for many years, in which time the actors change, the policy environment changes, the priorities change and other processes are initiated or become dominant. Evidence of this is found in all three of the Cape Town adaptation process case studies, which

have collectively been underway for around twelve years (as summarised in table 5) and yet none can be shown to have completed one cycle of decision making to the point of formal, explicit evaluation and adjustment. The adaptation pathways model does a better job of conceptually representing the numerous decision points and process bifurcations over time, but the suggestion that these can be mapped out in advance and proliferate in number into the future is not supported by the evidence from Cape Town. The lack of attention given to questions of who is involved how in influencing and making the numerous decisions is a weakness of the pathways model. The streams model and subsequent rounds models of public policy decision making that have been developed outside of the field of climate adaptation, offer much in the way of augmenting the conceptual weaknesses of the pathways model that currently dominate climate adaptation theory.

The field of climate adaptation has much to gain from engaging further with the insights generated in organisation studies, particularly those contributing to the evolution of behavioural decision theory and conceptual models of decision making within organisations, both public and private. For example, the advocacy coalition framework developed to understand policy decision-making processes that unfold over decades could be one interesting research avenue to explore further in relation to urban climate adaptation. Drawing on decision-making research in organisational and policy studies can help in addressing the current imbalance in the field of urban climate adaptation studies that has to-date focused primarily on studying the options for adapting to changes in the climate affecting cities, without enough being understood of the ways in which decisions pertaining to climate adaptation are taken in light of the uncertainty, contingency and contestation inherent in the nature of the climate change problem. By distinguishing between research focusing on the content and that focusing on the process of decision making, and arguing for the need to understand both in order to explain how change happens and complex problems are addressed, the field of organisational decision-making research offers much in the

way of further developing climate adaptation theory. Moving beyond the organisational framing of adaptation as decision making deployed in this study, there may be additional analytical value and explanatory power in revisiting and further extending the Cape Town case through alternative theoretical framings, notably those of political ecology and resilience in socio-ecological systems, to progress our understanding of persistent, unequally distributed and in some cases increasing climate risks and vulnerabilities at the city scale.

Annex 1: Terms of reference

Terms of Reference for Mistra Urban Futures Embedded Researcher: Anna Taylor
March 2012

Introduction
This document lays out the scope of work and terms of the working arrangement between the City of Cape Town (CCT), the African Centre for Cities and Anna Taylor (the researcher) under the Mistra Urban Futures (MUF) knowledge partnership, specifically relating to the climate change policy research area. It is, however, recognised that this arrangement is by nature exploratory and that a degree of flexibility will be required by all parties to accommodate changes that may arise as the project evolves.

Background
MUF general
The mission of MUF is to have an impact on urban sustainability challenges by creating new capacities within these diverse urban pathways to generate innovative solutions that are academically excellent, practically effective and socially relevant. This will be achieved by:

- The development and promotion of new types of urban knowledge production and problem-solving
- Setting up new partnerships and arenas for coordinating diverse actors and promoting mutual learning
- Creating new tools and skills for planning and implementation

MUF will concentrate on three Focus Areas and two Methodological Priorities.
Focus Areas:

1. FAIR Cities: Harnessing individual and collective capacities for public good
2. GREEN Cities: Managing resource constraints and climate change
3. DENSE Cities: Promoting urban qualities, access, livability

Methodological priorities:

4. MODES: Joint knowledge production and problem-solving
5. TOOLS: Tools and methods for communication and learning

MUF is unique in its combining of a holistic approach to urban development with a specific focus on local-global interactions, collaboration, and learning. The work outlined in this TOR will contribute mainly to the green cities MUF theme that considers managing resource constraints and climate change.

Knowledge Transfer project
The secondment of ACC researchers to the CCT is one component of the Knowledge Transfer project under the broader MUF MOU between UCT and the CCT. Participation in the Knowledge Transfer Project is for academic researchers to work with and within the CCT to undertake original research for publication or postgraduate dissertation. The research will be related to a specific subject that is of interest to the researcher and the ACC and of priority to the CCT in terms of enhancing urban development, sustainability or resilience through addressing critical knowledge gaps or policy areas.

Climate change policy process in the CCT
In order to manage climate-related risks to the CCT and its residents, to meet international commitments on climate change, access climate funds, and limit emerging climate-related liabilities the CCT needs

sound policy for addressing climate change and developing sustainably, on the basis of which citizens can hold their representatives to account. The challenge of developing a climate change policy for Cape Town is to conceptually design it using the latest available science to make it robust, recognising and accounting for existing limitations and knowledge gaps, while institutionally designing it with sensitivity to the practices and internal logics of the CCT to make it broadly legitimate and operable. Identifying and explicating the discursive struggles over giving meaning to climate change within the CCT will hopefully help in opening up the debate to find shared meaning and values as a basis for policy-making to address climate change. The administrative codification and embedding through various bureaucratic formats of the policy ideas will not be the responsibility of the researcher. Rather, the primary focus of the researcher will be on creating a climate change policy frame that is coherent, informed by local realties and understood by local officials to the extent that it aids adoption and implementation.

PhD research

This research residency forms a central part of a PhD study seeking to advance our understanding of the relationship between knowledge and policy action on climate change in cities of the Global South. The central research question of the study is: how is long-term climate change articulated and given meaning within the metropolitan local government of cities in the Global South facing many immediate developmental challenges? Sub questions include: which scientific knowledge claims on climate change feature in the local decision making of cities in the South, and how; how are social meanings of climate change produced and reproduced locally in the practices and experiences of those working within the CCT; what is the nature of the discursive struggle evident amongst politicians and officials within the CCT when it comes to giving local meaning to climate change?

Data will be collected through:

- participant observation in meetings convened by the City Council, various departments within the City Administration, the Climate Change Think Tank and the Cape Town Climate Change Coalition;
- semi-structured interviews with relevant CCT officials and politicians, as well as consultants and advisors to the CCT; and
- textual analysis of documents produced within / for the CCT.

<u>Aim</u>

To strengthen, progress (CCT) and better understand (ACC/UCT) the climate change policy design process by bringing a specialising climate change researcher into the CCT over a prolonged period (as compared with regular consultancies) to engage and work directly with CCT politicians and officials operating in and across a range sectors / line functions on building climate change into strategic CCT decision making and long-term planning.

<u>Objectives</u>

ACC/UCT: to experiment with new methodologies for producing knowledge on how climate change is expressed, problematised, prioritised and made legible within a developmental local government.

CCT: to gain extra capacity and expertise for designing a climate change policy that is based on a sound and progressive legal and fiscal framework, binds the CCT to the international commitments that have been agreed, and positions the CCT to access national and international climate change funds.

Knowledge Partners

Name	Position
Sue Parnell	PhD supervisor, ACC, EGS Department, UCT
Zarina Patel	MUF coordinator, ACC, EGS Department, UCT
Geoff Oelofse	Head of Environmental Policy and Strategy, ERMD, CCT
Sarah Ward	Head of the Energy and Climate Change Programme, ERMD, CCT
Susan Mosdell	Manager of the Property, Environmental and Planning Law Unit, Legal Services Department, CCT

As laid out in the MOU between the CCT and ACC, Sue Parnell and Zarina Patel will be responsible for all academic review and supervision as well as alignment of this project with the MUF International Pilot Project. Gregg Oelofse, Sarah Ward and Susan Mosdell will act as internal CCT advisors and knowledge partners to the researcher, reviewing all non-academic outputs produced by the researcher while seconded to the CCT. These officials, together with those advising the other 3 MUF/ACC researchers, the 4 MUF researchers and the MUF coordinator, will jointly form the Practitioner Advisory Group, which will meet regularly to ensure ongoing integration of the different components of the Knowledge Transfer Project and compliance with the aims and objectives of the MUF programme.

Timing and Duration

The research residency is expected to be for a period equivalent to 7 months per annum in the CCT, on the basis of an average 4 days a week spent in the CCT to fully engage in the day-to-day operations of the relevant departments, participate in meetings and workshops, build the working relationships necessary to progress the policy work internally, conduct interviews and focus groups, write reports and give presentations in the CCT, and 1 day a week at UCT to capture and clean data, access and review academic sources, attend seminars and meetings. During the 5 months each year when the researcher is based at UCT the inverse applies, i.e. on average 1 day a week will be spent in the CCT to maintain some continuity. While the 7:5 months and 4:1 days split provides a guideline, the researcher has some flexibility to reallocate time at their discretion to facilitate key engagements. The first secondment / residency term is expected to start on or about 1 April 2012. The knowledge exchange project runs until December 2014. Leave will be determined in accordance with requirements specified by the UCT Research Contracts office.

Operational requirements

The CCT will provide appropriate working support, including office space, office equipment, landline and IT facilities (hardware and software), parking and any other essentials necessary to function effectively while seconded to the CCT from ACC. The ACC will provide office space, office equipment, IT facilitates and library access for the time the researcher is based at UCT.

Tasks

The MUF/UCT researcher will be physically based in the Environmental Resource Management Department (ERMD) and formally attached to the Legal Services Department.

Tasks include:
CCT

- Map the political and administrative structures and procedures of the CCT with a climate change policy lens to understand the policy-making process and identify key people to interview and forums to present in
- Review of climate change policies from other cities for key components, strengths and weaknesses
- Review existing work that has been undertaken or commissioned by the CCT on climate change (e.g. fiscal and legal review work, Energy and Climate Change Strategy and Plan of Action, sea-level rise assessment, CAPAs, ecosystem services assessment, etc.)
- Identify and review existing sectoral and cross-sectoral policies and policy debates that a stand-alone climate change policy might affect or be affected by to establish the potential scope of such a policy
- Review national and provincial climate change policy and legislation
- Interview City councillors, officials and consultants on whether and how climate change is featuring in their work currently and the possible future implications of climate change on their work
- Draft a discussion paper on the conceptual underpinnings / design principles of a climate change policy for the CCT that establishes a frame to have a shared discussion about the components and modalities of a Cape Town Climate Change Policy
- Present the discussion paper in various CCT forums (committee meetings, the Think Tank, sub council meetings, etc.), collect, collate and respond to feedback and inputs
- Work with CCT officials to draft a Climate Change Policy document

UCT

- Conduct and write up PhD research based on participant observation, interviews and focus groups with City councillors and officials and a systematic review of relevant academic literature
- Collect and analyse data to contribute to addressing the MUF Pilot Project research questions
- Conduct and write up FliCCCR & AFD research based on interviews, workshops and a review of the relevant academic literature
- Participate in the ACC PhD seminar series

<u>Outputs</u>

CCT

- Institutional map explicating the formal policy-making process
- Discussion paper on the conceptual underpinnings of a climate change policy for Cape Town
- Think Tank presentation
- Annual reports to the relevant CCT Portfolio Committee
- Co-authored draft of a Climate Change Policy

UCT

- PhD monograph (3 draft PhD chapters in 2012)
- Quarterly MUF reports
- Contributions to MUF Pilot Project reporting in September
- Conference papers (e.g. South African Society of Geographers Conference in June and/or the SA City Studies PhD workshop in September 2012)
- AFD book chapters
- Contributions to IDRC book chapter(s)
- Contributions to co-authored review paper for WIREs on climate change in SA with Mark New and Gina Ziervogel

The tasks and outputs listed above will be reviewed half way through and at the end of each 7-month block at the CCT to check progress, identify divergence or stumbling blocks, and revise them accordingly to keep this document realistic, commonly understood and agreed to.

The researcher cannot be expected to be familiar with CCT protocols and events, and will depend on knowledge partners in the CCT for guidance on this. This is particularly the case in the first year. Similarly, the researcher will depend on CCT officials for the necessary introduction and in identifying the relevant portfolio committee events and other platforms within the CCT in which to present work to secure the appropriate levels of support and peer review.

The researcher will assist, where applicable, in “embedding” a CCT official in an appropriate Department at UCT.

Remuneration

The research will receive a bursary of R200,000 plus PhD registration fees per annum.

Annex 2: List of interviewees and focus group discussants

Position of interviewee at time of interview	Name	Method(s) / type(s) of engagement	Date(s)
CCT Official, Environmental Resource Management Department, Policy and Planning	Gregg Oelofse	Interviews plus multiple informal discussions	24 February 2012; 4 April 2012; 24 April 2012; 19 July 2012; 29 August 2012; 27 September 2012; 21 November 2012; 12 February 2014; 18 February 2014
CCT Official, Environmental Resource Management Department, Coastal Management	Darryl Colenbrander	Interviews plus multiple informal discussions	11 April 2012; 6 August 29012; 6 November 2012; 27 October 2014
CCT Official, Environmental Resource Management Department, Director	Osman Asmal	Interview	13 April 2012
CCT Official, Environmental Resource Management Department, Sustainability Reporting	Amy Davidson	Interviews plus multiple informal discussions	17 April 2012; 26 April 2012; 29 October 2012
CCT Official, Utility Services	Barry Coetzee	Interview	19 April 2012
CCT Councillor, Mayoral Committee Member for Economic, Environmental and Spatial Planning	Belinda Walker	Interview	25 April 2012
CCT Official, Legal Services Department	Susan Mosdell	Interview	4 May 2012
Consultant to the Environmental Resource Management Department	Penny Price	Interviews plus multiple informal discussions	8 May 2012; 5 July 2012
CCT Official, Disaster Risk Management Centre	Chris Konings	Focus group discussions	29 May 2012; 6 November 2012
CCT Official, Disaster Risk Management Centre	Greg Pillay	Focus group discussion	29 May 2012
CCT Official, Disaster Risk Management Centre	Charlotte Powell	Focus group discussion	29 May 2012
CCT Councillor, Economic, Environmental and Spatial Planning Portfolio Committee	Garreth Bloor	Interview	30 May 2012

CCT Official, Environmental Resource Management Department, Major Programmes and Projects	Stephen Granger	Interviews plus multiple informal discussions	6 June 2012; 19 December 2012; 1 August 2012; 9 May 2016
CCT Official, Transport for Cape Town, Sustainable Transport	Matthew Moody	Interview; focus group meeting	18 July 2012; 9 November 2012
CCT Official, Spatial Planning and Urban Design Department	Catherine Stone	Interview	19 July 2012
Consultant to the Environmental Resource Management Department	Lucinda Fairhurst	Interview	13 August 2012
CCT Official, Environmental Resource Management Department, Biodiversity Branch	Clifford Dorse	Interview and site visit	30 October 2012
CCT Official, Environmental Resource Management Department, Biodiversity Branch	Patricia Holmes	Focus group discussion	6 November 2012
CCT Official, Water and Sanitation Department, Bulk Water Branch	Peter Flower	Focus group meeting	7 November 2012
CCT Official, Specialised Health Services	Ian Gildenhuys	Focus group meeting	7 November 2012
CCT Official, Stormwater and Sustainability Branch	Rod Arnold	Focus group discussions; interviews plus multiple informal discussions	7 November 2012; 17 November 2014; 12 December 2014; 6 February 2015; 9 April 2015
CCT Official, Spatial Planning and Urban Design Department	Adele McCann	Focus group discussion	9 November 2012
CCT Official, Planning and Building Development Management Department	Schalk De Jager	Focus group discussion	9 November 2012
CCT Official, Transport for Cape Town, Sustainable Transport	Niki Covary	Focus group meeting; interviews	9 November 2012; 19 February 2014
CCT Official, Transport for Cape Town, Sustainable Transport	Gerhard Hitge	Focus group meeting; interviews	9 November 2012; 19 February 2014
Consultant to the Environmental Resource Management Department and convenor of the Climate Change Think Tank	Anton Cartwright	Interview plus multiple informal discussions	21 November 2012; 8 December 2014
CCT Official, Spatial Planning and Urban Design Department	Norah Walker	Interview	16 May 2013

CCT Official, Strategic Development Information and GIS Department	Carol Wright	Interviews	8 May 2012; 24 April 2013
CCT Official, Strategic Development Information and GIS Department	Natasha Primo	Interviews	8 May 2012; 24 April 2013
CCT Official, Local Economic Development	Samuel Chademana	Interview	24 July 2013
CCT Official, Housing Department	Peter Oscroft	Interview	11 November 2013
CCT Official, Environmental Resource Management Department, Head of Policy and Planning	Helen Davies	Interviews plus multiple informal discussions	1 September 2014; 19 November 2014; 2 July 2015; 15 February 2016
CCT Official, Stormwater and Sustainability Branch	Abdulla Parker	Interviews and focus group meeting	17 November 2014; 2 January 2015; 29 January 2015; 6 February 2015
CCT Official, Stormwater and Sustainability Branch	Ben de Wet	Interviews	12 December 2014; 12 March 2015
CCT Official, formerly of Stormwater and Sustainability Branch, then Water and Sanitation Department	Barry Wood	Interview	17 March 2015
Western Cape Economic Development Partnership, former City Manager for the CCT	Andrew Boraine	Interview	29 July 2015
CCT Councillor, Executive Deputy Mayor and Mayoral Committee member for Finance	Ian Nielson	Interview	2 July 2015
CCT Official, Office of the Executive Mayor, Strategic Policy Unit	Craig Kesson	Interview	15 July 2015
CCT Official, Transport for Cape Town, Asset Management and Maintenance, Informal Settlements Network	Hilton Scholtz	Focus group meeting	6 February 2015

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