

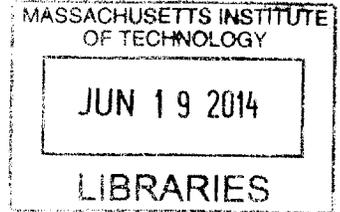
**Funding for Adaptation to Climate Change:
The Case of Surat**

By

Toral Patel

BA in Geography and Political Science
Middlebury College
Middlebury, Vermont (2009)

ARCHIVES



Submitted to the Department of Urban Studies and Planning
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Signature redacted

Author _____

Department of Urban Studies and Planning
May 22, 2014

Signature redacted

Certified by _____

Professor James Wescoat
Department of Urban Studies and Planning
Thesis Supervisor

Signature redacted

Accepted by _____

Associate Professor P. Christopher Zegras
Chair, MCP Committee
Department of Urban Studies and Planning

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Abstract

The need for cities to adapt to climate change is widely acknowledged, yet the question of adaptation finance remains uncertain. Unable to access global climate funds, cities must seek out alternative sources to support their adaptations to climate change. This is particularly challenging for local governments in India, where incomplete fiscal decentralization has resulted in severe developmental deficits and resource constraints. Using Surat, Gujarat, as a case study, this research examines how cities in India might fund climate adaptation despite limited fiscal and administrative autonomy. It furthermore explores how the urban finance system might affect the implementation of climate adaptation strategies at the city level.

Evidence comes interviews with key officials, municipal budget data, and public planning documents. The case study suggests that cities can effectively marshal funds from international, national and state sources to invest in climate adaptation. Some of these funding sources explicitly support adaptation, whereas others are linked to broader urban development or disaster risk reduction objectives. The research findings indicate that relying on external sources has required trade-offs between policy agendas, resulting in a fluid understanding of “climate adaptation” on the ground. While the urban finance system appears to have encouraged experimentation in Surat, it may constrain the effectiveness of climate adaptation at the city level. Dependence on intergovernmental transfers and grant aid limits the ability of cities in India to set and maintain local priorities, thereby narrowing the scope for effective and sustainable climate adaptation outcomes. Limited fiscal autonomy has hindered access to alternative sources to finance, such as public-private partnerships and municipal bonds. It has also contributed to a project-based approach that may compromise a longer-range and more comprehensive vision for adapting to climate change. In this setting, experimentation and innovation in financing climate adaptation at the city level will be crucial to moving forward.

Keywords: urban climate adaptation, municipal finance, multilevel climate governance, India

Thesis Committee:

James Wescoat, Aga Khan Professor, MIT

JoAnn Carmin, Associate Professor of Environmental Policy and Planning, MIT

David Dodman, Senior Researcher, International Institute for Environment and Development

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This thesis is dedicated to my grandfather, Vithal Harman Patel, whose love for learning and adventure has left an indelible mark.

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1: INTRODUCTION

The need for cities to adapt to climate change has become increasingly clear, yet funding for the necessary planning, actions and infrastructure remain highly uncertain. The issue of financing climate adaptation has lagged behind that of mitigation in the United Nations Framework Convention on Climate Change process (Bouwer and Aerts, 2006). This poses one of the greatest challenges to climate adaptation, particularly for cities in developing countries, which are disproportionately vulnerable to the current and expected impacts of climate change. Rapid rates of population growth and urbanization have contributed to staggering deficiencies in urban infrastructure and basic service provision, while proximity to rivers and coastlines has increased their exposure to climate-induced hazards (Ayers and Huq, 2009). The impacts of a changing climate not only exacerbate resource constraints, they also have the potential to erode developmental gains.

Climate adaptation measures, which aim to reduce vulnerability to climate change and to increase resilience, may require significant additional financial capacity in cities in developing countries. Estimates of the costs of adaptation in cities remain imprecise, but are in the range of tens of billions of dollars per annum globally. Of this estimate, one-third will be for developing countries, where the expense will likely be used for new construction and expansion of infrastructure and services (Ayers, 2009). However, existing international funding to support climate adaptation needs in developing countries falls significantly short of meeting the actual costs of adaptation. Given these resource constraints, the idea of “mainstreaming” – or integrating climate adaptation and resilience programs into existing development planning paradigms – has gained increasing importance (IPCC, 2014). Advocates point to the combined potential of these policy agendas to ensure the long-term resilience of cities, but often do not give adequate attention to their differences.

In addition, there are critical gaps in information and capacity. It is unclear what is needed to establish and sustain climate adaptation planning at the city level, especially since information

at the relevant scale is lacking (Carmin et al., 2012a). Even so, it is widely acknowledged that cities must take the lead in adaptation efforts given that local social, economic and political relations shape climate vulnerabilities (Anguelovski and Carmin, 2011). Low levels of technical, financial, and managerial capacity of local governments, however, make it difficult for cities to effectively manage climate risks (Ayers and Dodman, 2010; Carmin et al., 2012b).

Over the past decade, a number of private, non-state and intergovernmental actors have begun to fill this financial and technical capacity gap by providing support for climate adaptation planning and implementation in cities (Ayers, 2009). New organizations and networks are engaging with the problem of climate change, while existing non-government organizations, philanthropic foundations and donor agencies are including it in their work (Anguelovski and Carmin, 2011; Betsill and Bulkeley, 2007). This web of actors operates at a variety of scales, interacting with local, regional, national and international institutions at each scale. In parallel, there has been an increase in public and private funding streams for climate adaptation and mitigation, providing further incentive to integrate climate considerations in existing development policies and programs (Fisher, 2010). However, the challenge of integrating climate adaptation and development policy agendas remains; there are a number of unresolved tensions and discrepancies that have begun to play out at the city level.

There is a need to better understand how cities are accessing and using funding from different sources to support local adaptations to climate change. How cities navigate an increasingly complex policy, institutional and fiscal landscape for climate change can have important consequences for the extent and effectiveness of adaptation. Accordingly, this research focuses on the following questions:

1. How can cities in India draw upon different sources of funding to support local adaptations to climate change?
2. How might the urban finance system affect the implementation of climate adaptation strategies in these cities?

These questions aim to explore the fiscal context of climate adaptation at the local scale. To address them, I develop a case study on Surat, Gujarat, which provides a snapshot of how one city in India has sought out funding for climate adaptation from international, national, state and local sources. Because Surat operates in a context of fiscal and administrative constraints, it has relied heavily on external sources to fund its climate adaptation efforts. While some sources explicitly support adaptation, others are more oriented toward urban development or disaster risk reduction agendas. In order to access these diverse funding sources, the city has been creatively reframing its planned projects to emphasize their co-benefits for multiple policy agendas. Local understandings of “climate adaptation” have in effect become remarkably fluid. To some degree, relying on external sources has required trade-offs between adaptation, development, and disaster risk reduction priorities. As such, the intersection of multiple policy agendas at the city level underscores the need for greater policy coherence across the multiple tiers of climate governance in India. Furthermore, the urban finance system has affected the implementation of climate adaptation strategies, constraining a city’s ability to set local priorities and to pursue alternative funding sources. Weighing the advantages and disadvantages of the ensuing vulnerability reduction-focused and project-based approach to climate adaptation will be essential for cities in India.

In Chapter 2, I outline how the concept of multilevel governance helps to understand the complex policy, institutional and fiscal landscape for climate adaptation. I point to the enduring need for action at the city level, despite various constraints. In Chapter 3, I provide context on structures of urban governance and the drivers of climate change policy in India, which develops a basis for the case study selection. I then detail the research design, including methods of data collection and analysis. In Chapter 4, I present the findings from my research to build a finance-based narrative on Surat’s experience in institutionalizing and investing in climate adaptation. In Chapter 5, I further examine the research findings to understand how the urban finance system is enabling or constraining climate adaptation in Surat. In Chapter 6, I draw lessons from the Surat case study for implementing climate adaptation in other Indian cities.

2: CONCEPTUAL FRAMEWORK

2.1 Multiple Scales of Action and Influence

City governments are in a unique position to undertake climate adaptation planning and implementation. Among other strengths, they have a strong understanding of local needs and vulnerabilities, as well as the ability to experiment with policy responses. However, there are marked constraints in resources and capacity at the local level. Increasing resources at national and international levels, moreover, require situating local climate action in a broader framework for multilevel governance. This conceptual framework underscores the need for coordination between actors across vertical and horizontal scales of governance in order to formulate robust climate adaptation strategies.

Adaptation to climate change at the city level

Climate adaptation refers to the adjustments in behavior, livelihoods, infrastructures, laws, policies and institutions in response to actual or expected climatic impacts, according to the Intergovernmental Panel on Climate Change (IPCC, 2014; Schipper et al., 2008). These adjustments aim to reduce the vulnerability of populations, households and individuals (Satterthwaite et al., 2007). At the city level, adaptation measures might include structural approaches that focus on upgrading buildings, infrastructure and technologies. They also include non-structural approaches, such as sectoral coordination strategies, civil society engagement, public awareness programs, integrated resource management, design standards, and policy incentive structures (Tyler and Moench, 2013).

The literature on adaptation to climate change emphasizes the importance of local action for a number of reasons (Hunt and Watkiss, 2010; Carmin et al., 2012). First, the impacts of climate change are manifested locally, affecting local livelihood activities, economic enterprises and human health. Moreover, vulnerability and adaptive capacity are shaped by local economic, social, geographic, demographic, cultural, institutional, governance and environmental factors (IPCC, 2014). Second, the concentration of people and hazards in cities provides significant

scope for effective local adaptation (Dodman and Satterthwaite, 2008). Cities are well positioned to design solutions that are both adapted to the needs of local stakeholders and consistent with local policy priorities. This is particularly important because climate change impacts may be uneven across income groups, and may require local government intervention. In addition, the responsibility for implementation also means that cities can better monitor and evaluate policies, programs and projects supporting climate adaptation. Third, local authorities have jurisdiction over several areas that are key to climate adaptation, from land use planning and zoning to water supply and waste management. As such, they can reform existing local policies and urban planning practices to integrate climate adaptation into urban infrastructure and development patterns. This offers opportunities for experimentation and learning about climate change at the local level, and can contribute to policy development at broader scales (Corfee-Morlot et al., 2009).

However, there are a number of obstacles to effective climate adaptation planning and implementation at the city level. The lack of expertise in integrating climate science into local planning and decision-making processes pose a significant barrier. The lack of national policy and regulatory frameworks to support urban climate governance presents another difficulty, as do limitations of decentralized authority in the developing country context (Hunt and Watkiss, 2010; Romero Lankao and Qin, 2011). Moreover, municipal governments face major constraints in fiscal resources and administrative capacity, which are further compounded by high rates of population growth and an increasing infrastructure deficit. The imperative for adapting to climate change puts additional pressure on these barriers and constraints (Adger et al., 2003; Ayers and Dodman, 2010).

Multilevel governance and climate change

Given the need for local action but the limitations in local resources, climate change appears to have rescaled traditional conceptions of urban governance (Swyngedouw, 2005). While impacts are felt locally, the scale and extent of potential climate change impacts to social and ecological systems transcends administrative boundaries. The concept of “multilevel governance”

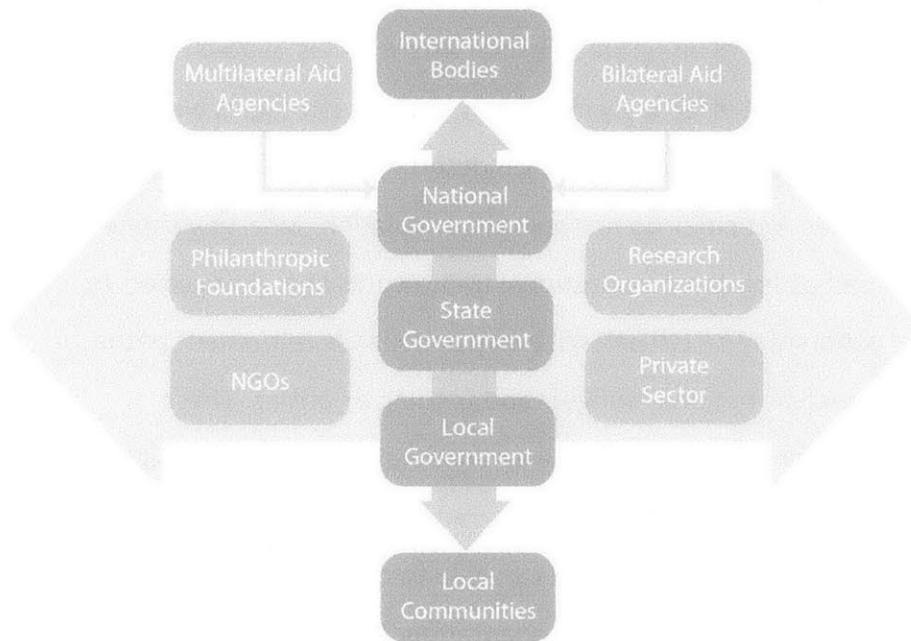
describes the interlinking of capacities and resources across vertical and horizontal dimensions to address this trans-boundary challenge. This framework helps to understand how public and private actors interface to design and implement climate adaptation policies for international to national and local levels of action (Corfee-Morlot et al., 2009).

The vertical dimension of the multilevel governance framework for climate adaptation recognizes the importance of strategic and integrated policies across levels of government (Figure 1). National governments cannot effectively implement climate strategies without working closely with regional and local governments, which determine the specific details of land use and transportation policies. Yet cities do not operate in isolation: local governmental authority to act is strongly shaped by legal and institutional frameworks at higher scales. In particular, the scope for local action may be circumscribed by national development paths, policies, technical standards, as well as national budgets and funding priorities. These relationships underscore the need for coordination between national and sub-national levels of government. Coordination, moreover, can help to ensure technical and financial support from the national government for local adaptation. Finally, it can help to protect against externalities and spillovers of local policies that might produce “mal-adaptations” and reverse aggregate progress (Corfee-Morlot et al., 2009; Hooghe and Marks, 2003).

The horizontal dimension of the multilevel governance framework captures the widening range of actors, institutions and networks that influence climate adaptation planning and implementation in cities (Bulkeley, 2005). At a basic level, horizontal interactions refer to coordination and communication between neighboring local jurisdictions within a metropolitan area. But these linkages also extend to a number of non-government organizations and community-based organizations, international non-governmental organizations, multilateral and bilateral aid institutions, philanthropic foundations, research organizations, and partnership networks that span national boundaries (Anguelovski and Carmin, 2011; Moench et al., 2011). Many of these non-state actors aim to encourage cross-scale learning and cooperation between relevant institutions, and are crucial in providing information, creating

knowledge, and forging norms in climate adaptation planning at the city level. Moreover, they facilitate access to critical outside funding sources to leverage cities' own revenues, although these funds are typically awarded on a competitive basis (Betsill and Bulkeley, 2007). As such, multilevel governance has opened up an array of funding sources to support climate adaptation.

Figure 1. Actors in the Multilevel Governance Framework for Climate Adaptation



2.2 Funding for Climate Adaptation

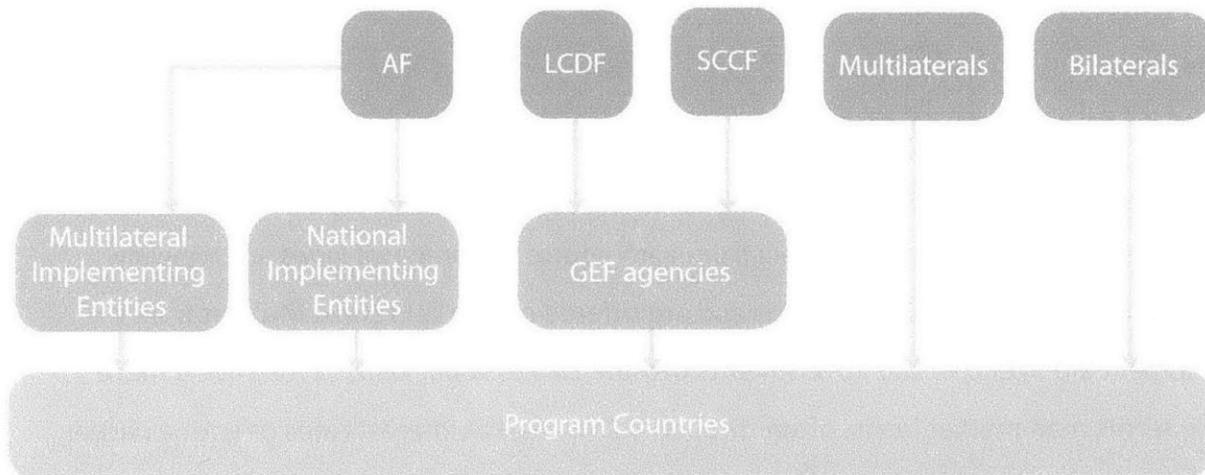
The multilevel governance framework has opened up a range of resources to support climate adaptation planning and implementation. However, there are major limitations in the funding sources available to support action at the city level. Many of these funds are insufficient in quantity or inaccessible to local governments. This has meant that cities must draw upon a number of funding sources, each with its own set of priorities. In particular, there are three main policy agendas associated with common funding sources for measures to reduce climate vulnerability: climate adaptation, urban development, and disaster risk reduction. These policy agendas have important convergences and divergences.

Sources of adaptation finance and their limitations at the city level

Within the scaffolding of multilevel governance, there are a number of sources that offer financial support for climate adaptation. Each source has marked potential and limitations in the ability to support adaptation action at the city level.

International funding to support climate adaptation in low- and middle-income countries comes from two main sources: dedicated climate change funds under the United Nations Framework Convention on Climate Change (UNFCCC) and official development assistance (Ciplet et al., 2013). The former is an umbrella for three distinct global funds created in 2006: (1) the Least Developed Country Fund (LDCF), which aims to support the least-developed countries in conducting National Adaptation Programs of Action, (2) the Special Climate Change Fund (SCCF), to support climate-related activities including technology transfer, mitigation and adaptation, and (3) the Adaptation Fund (AF), which funds concrete adaptation projects from the proceeds of a 2 percent tax on the Clean Development Mechanism of the Kyoto Protocol (Bouwer and Aerts, 2006; Lemos and Boyd, 2009; UNFCCC, 2008).

Figure 2. Diagram of International Public Climate Finance

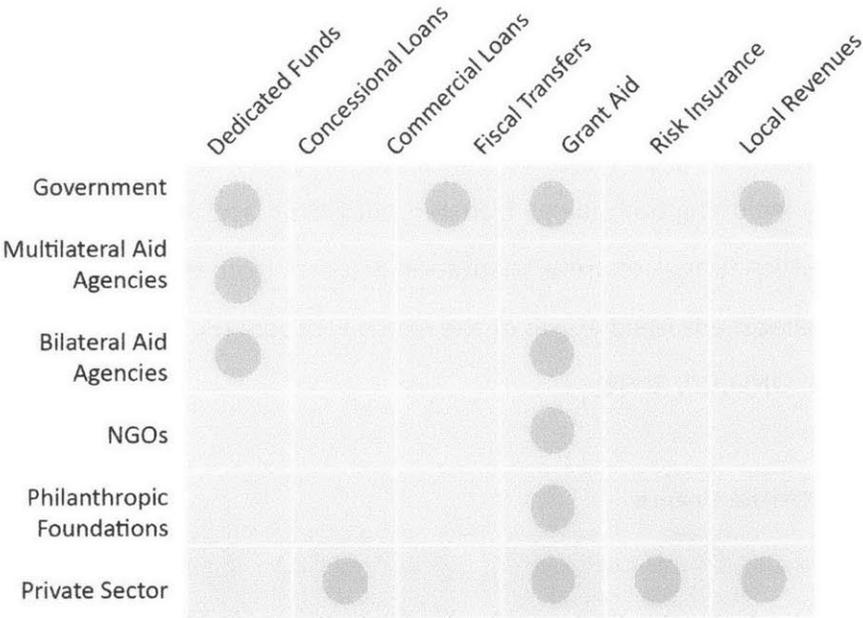


Adapted from Glemarec (2011)

However, these UNFCCC funds are not directly accessible to cities, as Figure 2 illustrates. The first two funds, administered by the Global Environment Facility (GEF), are accessed through multilateral development banks, whereas as the third only allows national and regional

institutions to apply directly for support (Smith et al., 2013; Wiebusch, 2012). As a result, civil society groups and local levels of government have had little opportunity to access these resources. Contributions to these funds from developed countries, moreover, are essentially voluntary and insufficient to meet needs. According to most objective assessments, these dedicated funds represent a small fraction of the global need for adaptation funding, creating a multi-billion dollar investment shortfall (Ayers, 2009).

Figure 3. Sources and Types of Funding for Climate Adaptation at the City Level



Fortunately, other funding sources to support climate adaptation are more accessible. Figure 3 describes the types of funding available from each source. *Commercial loans* are typically supplied by private financial institutions and are offered on market terms. Multilateral development aid agencies and governments provide *concessional loans* on relatively more flexible terms than market loans, often through below-market interest rates or with a partial grant component. *Fiscal transfers* refer to the transfers of funds from higher levels of government to lower levels to support general government operations. *Grant aid* refers to funds allocated for specific projects or purposes, with no repayment. *Risk insurance* transfers the risk of physical and economic losses from individuals and entities to an insurer in exchange

for payments. *Local revenues* are mainly constituted by various taxes, user charges, and private spending.

Multilateral and bilateral development aid agencies can provide support to city governments for infrastructure enhancement, service improvement or capacity building through official development assistance (ODA). Financial instruments most often entail concessional loans and grant aid (Figure 3). According to a recent analysis by the Climate Policy Initiative, these institutions have played a significant role in financing climate adaptation, in part due to their long-standing expertise in providing development assistance (Buchner et al., 2013). It reports that adaptation is predominantly financed through bilateral institutions (\$3.6 billion out of \$4.4 billion), followed by multilateral institutions (\$475 million) and voluntary contributions or philanthropy (\$210 million). A relatively small share (\$65 million) is provided by dedicated climate funds.

However, ODA supports a number of target areas in which it is often difficult to distinguish adaptation projects (Huq and Reid, 2004). This contributes to the difficulties in tracking adaptation funding, as well as to deeper systemic problems around defining what exactly qualifies as adaptation funding (CPI, 2013; Schipper, 2007). Moreover, access to ODA can be difficult due to inaccessible and time-consuming procedures, as well as ineffective distribution mechanisms (Mitchell et al., 2008). Finally, financial and technical support from multilateral and bilateral institutions varies widely in length, quantity and scope (Gomez, 2013). The same is true of support for climate adaptation from philanthropic foundations and non-governmental organizations (Revi, 2008).

There has been significant attention on the possible role of the private sector in filling the funding gap for climate adaptation. Private actors could offer commercial loans and credit enhancements to local governments; provide risk management to homeowners and businesses through insurance policies; and distribute necessary goods and services (Persson et al., 2009). The hope is that successful private sector engagement in adaptation will catalyze greater and

more frequent investments in innovation, which could lower the costs and accelerate the replication of climate-resilient technologies and services in core development sectors (Biagini and Miller, 2013). However, the private sector is generally motivated by profit incentives, and is unlikely to invest in capacity-building, policy reform processes and infrastructure over the long-term or at a large scale – especially in countries with poor credit ratings, high levels of debt, limited institutional financial capacity and significant barriers to capital (Brown and Kaur, 2009). Its engagement in climate adaptation may therefore be limited to measures to protect its own economic interests (i.e., construction of a private seawall or the decision to move out of climate vulnerable areas).

Local revenue streams are an important source for financing investments in climate adaptation. Taxes and user charges can help pay for maintenance of infrastructure assets and small scale retrofitting. They can also provide revenues for sustained maintenance. However, while many cities have legal and institutional authority over revenue instruments, they are constrained in their ability to collect enough revenue to cover basic expenditure responsibilities (i.e., the provision of local roads, water, solid waste, sewerage, and transportation). Moreover, increases in taxes and user charges are met with intense political opposition. In developing countries, weak administrative capacity along with unclear property rights, rapid population growth and urban informality pose major barriers to efficient revenue management (Bird and Vaillancourt, 1998). Cities can also levy a range of development charges, or impact fees, to offset the cost of extending infrastructure services to new developments. Although municipal bonds are a principal means for urban infrastructure investment in developed countries, the market has proven difficult to build in developing countries where strong legal provisions for default protection, tax incentives, and standardized procedures are often lacking (Mohanty et al., 2007).

Grant aid and fiscal transfers from state and national levels of government, though often result in dependency, are a critical supplement to local revenue streams. These funding sources enable local governments to fulfill their expenditure obligations, make long-term capital investments, and meet benchmarks for service provision (Venkatachalam, 2008).

Intergovernmental transfers play an important role in correcting the imbalance between expenditures and revenues at each level of government (Rao and Bird, 2010). They typically come in the form of block grants for either general or specific purposes (Garg, 2007). Conditional fiscal transfers, furthermore, make grant disbursement conditional on specified programs and reforms. They are used to pursue national development agendas, for instance, to ensure that “pro-poor” investments are incorporated into local planning and budgeting actions (Bird and Smart, 2002). Despite the attached conditions, such transfers afford cities some flexibility in deciding how exactly to spend the funds (Mohanty et al., 2007).

Convergences and divergences of policy agendas

The limitations in any single funding source has made it necessary for cities to draw upon multiple sources to support local climate adaptation efforts. The term “convergence funding” has recently emerged to describe inter-sectoral initiatives to address rural poverty alleviation in India. Substantial public investments are being made to strengthen the rural economy and secure livelihoods of the poor. The convergence of funding from different programs across scales has brought synergies to the planning process and implementation of these rural initiatives, thereby contributing to more durable outcomes (MRD, 2010). Funding for climate adaptation may follow a similar pattern. However, climate policy priorities and requirements may be inconsistent across funding sources due to the varying influences of local, state, national and international politics and programs. Multilevel governance thereby introduces significant complexity in the ways in which actors, organizations and institutions seek to shape climate policy. This is perhaps most evident in financial support, which is typically tied to explicit conditions and motivations. As such, various policy agendas intersect at the city level, sometimes converging and sometimes diverging (Dodman and Mitlin, 2013; Lemos and Boyd, 2009).

Dedicated climate funds from the UNFCCC are associated with a specific conception of climate adaptation. These top-down funding streams reflect multilateral negotiations and debates around climate action and justice (Atteridge et al. 2012). In this global arena, less-developed

countries point that they are least to blame for climate change and yet are likely to be the most vulnerable to its consequences. As such, they argue that they should be supported in responding to, coping with and adapting to negative climate impacts. While developed countries acknowledge their contribution to the climate change problem, they argue that their financial responsibility should be limited to supporting climate adaptation actions taken *in addition to* a baseline that developing countries would take in the absence of climate change (Lemos and Boyd, 2009). There has been extended controversy on defining such a baseline, which would determine how and how much climate finance is allocated to developing countries. Furthermore, the language around “additionality” has given rise to an expert-driven, technology-based view of climate adaptation among some developed countries. The emphasis is on responding to specific climate *impacts*, much more so than on reducing physical and social exposure to risk, or *vulnerability*. As such, this particular conception circumscribes the extent to which climate adaptation can address the non-climatic drivers of vulnerability in developing countries and contribute to more resilient development (Ayers and Dodman, 2010).

On the other hand, intergovernmental transfers and grant aid in the developing country context are focused on the need to improve basic services and livelihoods. From this perspective, climate adaptation and development become inseparable, if not synonymous. Climate adaptation is not an end state, but rather, part of a dynamic process. It encompasses any effort that improves upon the original conditions of an affected population in light of climate change – including initiatives in poverty reduction, health and education, infrastructure construction and resettlement policies (Agrawala and van Aalst, 2008). In short, it aims to address some of the structural inequalities that contribute to climate vulnerability (Schipper, 2007). This development-focused approach to climate adaptation aims to build the adaptive capacity of individuals, households and communities by increasing their ability to respond, cope and recover from the negative impacts of climate change (Lemos and Boyd, 2009). Because of significant overlap with the development agenda, several bilateral and multilateral development aid agencies have embraced the idea of “mainstreaming” climate adaptation into existing development planning and ODA resources (Huq and Reid, 2004; Schipper and Pelling,

2006). The World Bank, German Society for International Cooperation (GIZ), and Norwegian Agency for Development Cooperation (Norad), to cite some prominent examples, have begun to factor climate risks into their ongoing development assistance activities (Agrawala and van Aalst, 2008).

However, the climate adaptation and development agendas do not always align, which poses challenges to their integration. First, there is a discrepancy between the immediacy of development priorities and the anticipatory nature of adaptation priorities (Cannon and Muller-Mahn, 2010). As such, there are direct trade-offs between short-term development priorities and longer-term considerations of climate change. Second, adaptation requires incorporating scientific knowledge about future trends into planning and policy processes. Yet the primary sensitivity of development planning to climate risks is at a *local* scale, for which robust climate change projections are often lacking. Third, existing development trajectories may be inconsistent with adaptation objectives and inadvertently contribute to vulnerability, for instance, by increasing dependence on climate sensitive resources (Ayers and Dodman, 2010). These divergences make it difficult to integrate the two agendas, despite their linkages. This difficulty is further complicated by the presence of a third key policy agenda across various levels of government in developing countries: disaster risk reduction.

The disaster risk reduction agenda may be linked with a range of funding sources, from official development assistance and philanthropic contributions to intergovernmental transfers and risk insurance. It refers to disaster prevention, preparedness and mitigation actions, and falls under the umbrella of “disaster risk management,” which also includes response, relief and reconstruction actions (Schipper and Pelling, 2006). There is a growing recognition that the increased frequency of disaster events – such as floods, droughts and storms – may be linked to climate change. Fortunately, disaster risk reduction and climate adaptation appear to have similar aims and mutual benefits (Weaver, 2009). They both seek to decrease *local* vulnerability and exposure to various hazards, in the context of wider efforts to address poverty and inequality. In effect, they share important linkages with development. Unmanaged disaster and

climate risks can stall socioeconomic development, while development can actually increase exposure to hazards, for instance, due to construction in flood-prone areas (Schipper and Pelling, 2006).

Yet there are divergences between the disaster risk reduction and climate adaptation agendas that may require different planning tools and approaches. The former understands the future in terms of past trends, whereas the latter understands that climatic trends can shift drastically in the future. Similarly, the time frames for the two agendas are distinct: disaster impacts are relatively immediate and concentrated, whereas the consequences of climate change, along with societal changes, may evolve over a longer time scale. In addition to shared concerns about climate-related hazards, both agendas have their own set of concerns. The disaster agenda encompasses non-climate related hazards, such as earthquakes, chemical spills and volcanic eruptions – whereas the climate adaptation agenda extends to the more gradual effects of climate change, including sea level rise, rising temperatures, and changing seasonal patterns (Schipper and Pelling, 2006).

These divergences warrant caution in integrating the disaster risk reduction, climate adaptation and development agendas. While there are certainly convergences that offer opportunities for coordination, overlooking their discrepancies may lead to ineffective or incomplete policy responses to the risks presented by climate change. Because these policy agendas are embedded in various funding mechanisms available for adaptation to climate change, cities must carefully navigate their convergences and divergences.

2.3 The Need for Institutional and Policy Integration

While the multilevel governance framework opens up a range of funding sources, it also introduces increased complexity into climate adaptation planning and implementation at the city level. There is a clear need to align various policy agendas in order to develop greater policy coherence and ensure effectiveness of climate adaptation at the local scale (Corfee-Morlot et al., 2009). Despite widespread acknowledgement of this need, coordination and integration of

funding and agendas pose an ongoing challenge. The task requires cities to orchestrate a diverse range of actors and institutions, as well as to manage policies and programs that are supported by multiple sources of funding (Agrawala and van Aalst, 2008). While the climate adaptation, development and disaster risk reduction agendas are not mutually exclusive, the climate adaptation agenda has important distinctions that must be maintained if integrated policy solutions are to effectively address the high levels of climate vulnerability in cities. The following chapter turns to India, where the intersection of these three policy agendas at the city level offers a rich setting for research.

3: RESEARCH CONTEXT AND METHODS

This chapter outlines the challenges facing urban areas in India. It draws attention to the vulnerabilities created by rapid urbanization and climate change, pointing to marked limitations in the autonomy of urban local bodies as a contributing factor. The chapter also reviews climate change policy at higher levels of government, and then describes the types of climate action being taken at the city level.

3.1 Climate Vulnerability in Indian Cities

This research focuses on India, where approximately one-third of the population lives in urban areas and the urban-rural ratio has steadily increased over the last century (Census of India, 2011). While the country's densely populated cities are the new engines of economic growth, most if not all are grappling with issues such as critical infrastructure deficits and inadequacies in the provision of basic services. High rates of rural to urban migration put pressures on these deficiencies, and result in sizeable populations of marginalized and highly vulnerable communities with limited skills, education, income and social capital (Sharma and Tomar, 2010). Due to systematic exclusion from the formal economy of the city, these communities live in hazardous sites and are exposed to multiple environmental health risks due to unreliable access to infrastructure and social services (Revi, 2008).

In addition to these urbanization challenges, India faces high risks related to climate change. Expected increases in the frequency and intensity of current hazards and in the probability of extreme events – alongside the emergence of new hazards and new vulnerabilities – may have significant repercussions for Indian cities. These projections require governments to manage multiple risks of rising temperatures, erratic rainfall, drought, flooding, cyclone, storm surge and sea-level rise – all of which will have differential impacts within and across cities. In particular, climate change is expected to further degrade the resilience of poor communities, which make up between one quarter and one half of the population of most Indian cities (Revi, 2008; Satterthwaite et al., 2007). For this reason, climate change risk in Indian cities is typically

associated more with social vulnerability than hazard exposure (Sharma and Tomar, 2010). It may create new vulnerabilities that exacerbate the resilience of the urban poor.

3.2 Urban Governance: Limitations in Local Autonomy

Urban local bodies in India have extremely limited fiscal and administrative autonomy, despite efforts at decentralization over the past two decades. The federal structure assigns matters of urban development to the state governments. While the 74th Constitutional Amendment of 1992 delegated governance functions and fiscal authority to urban local bodies, the extent of decentralization has varied from state to state (Garg, 2007; Sharma and Tomar, 2010). Overall, the devolution of governance functions has not been sufficiently accompanied by the devolution of fiscal authority to local governments. As a result, the limited ability to generate revenues makes it difficult for municipal corporations – or the urban local bodies for cities with over one million in population – to meet the growing mandates for infrastructure and basic services provision (Ahluwalia, 2011). Municipal corporations are often unable to levy rational user charges for the services they deliver, and statutory obligations limit their access to debt financing. The inefficient administration of property tax due to weak bureaucratic capacity for tax policy and collection, as well as unclear property rights, further constrains local revenues (Mohanty et al., 2007). Furthermore, most local governments are unable to access private financial resources for infrastructure development due to inadequate management capacity and weak financial standing (Nandi and Gamkhar, 2013). Faced with such a situation, municipal corporations in India are increasingly dependent on fiscal transfers from the state and national governments to fulfill their obligations and to make long-term capital investments in infrastructure development and poverty reduction (Revi, 2008).

The state's influence on urban governance is apparent in the administrative structure of various types of urban local bodies. First, municipal corporations are led by a state-appointed Municipal Commissioner, and are typically responsible for planning, zoning, investment, operations, and maintenance of public land and infrastructure within the territory designated as the urban local body, though the exact portfolio of services varies across states. Second, urban development

authorities are vested with power by the state governments to lead strategic regional spatial planning and make capital investments in the peri-urban areas of the city, and then transfer developed land to the urban local bodies. Third, many states also exert partial control over the management of local utilities through parastatal agencies, for example, municipal water and sewerage boards (Sharma and Tomar, 2010). Lack of coordination between these three bodies has resulted in overlapping jurisdictions and fragmented responsibilities on the ground, which has been a major factor in the poor delivery of urban services (Ahluwalia, 2011).

The Ministry of Urban Development and the Ministry of Housing and Urban Poverty Alleviation at the central government level provide policy guidelines to the state governments as well as financial and technical support in priority areas regarding urban development. While these ministries are important in pushing forward policy agendas, state governments have the final decision-making authority (Sharma and Tomar, 2010).

3.3 Climate Change Policy at the National and State Levels

Climate change has long been considered a distant foreign policy issue in India, confined to the realm of technocrats and diplomats (Fisher, 2010). Indeed, India is an influential actor in international climate negotiations, leading the ideological argument for equitable burden sharing. As such, it has resisted taking on emission reduction obligations, and has pushed for developed nations to take financial responsibility for addressing the climate problem (Atteridge et al., 2012).

The domestic policy agenda in India, in contrast, is focused on material needs and ambitions such as economic development and poverty alleviation. Nonetheless, the climate change issue has gained some attention with the release of the National Action Plan on Climate Change (NAPCC) in 2008. While this plan was initiated by the Government of India in response to developments at the international level, its eight national missions – water, agriculture, forests, Himalayan biodiversity, urban habitats, energy efficiency, solar energy and knowledge management – focus on domestic economic and social development needs (Sharma and Tomar,

2011). Climate-related objectives appear to be a secondary concern. It follows that the NAPCC missions linked to mitigation are motivated by material concerns over resource depletion, economic growth, energy access, and energy security. Furthermore, the missions linked to climate adaptation focused on poverty alleviation, livelihood protection, and social vulnerability reduction. In both, notions of resource efficiency and conservation are common (Atteridge et al., 2012).

NAPCC also legislated responsibilities for climate action to state governments, to help to facilitate multi-level government coordination and address local concerns. With assistance from multilateral and bilateral aid agencies, states have begun to draft state climate change action plans. Development priorities are strongly reflected in these plans, favoring mitigation actions in some states and adaptation in others. Gujarat, one of the most developed and industrialized states, has focused on mitigation. Motivated by a sense of economic opportunity, the state announced policies to attract federal dollars for and private investments in wind and solar energy. Other states have seen their state action plans as an opportunity to solicit more federal funds from relevant nodal ministries to support traditional development priorities, and have proposed large budgets for implementing their climate action plans (Atteridge et al., 2012).

Climate adaptation planning's links to disaster risk reduction have remained largely untapped in India. Issues of slow-onset effects and the need for climate resilient development have received attention, but have not been integrated into local and state level disaster management plans. While the NAPCC delineated high-level strategies for managing disasters, the National Disaster Management Authority (NDMA) was not highly involved in drafting it. Climate change is thus considered an "environmental matter," leaving the responsibility for adaptation to the Ministry of Environment and Forests. Consequently, the NAPCC represents a sectoral approach to reducing climate impacts neglects cross-cutting issues such as managing natural disasters.

Importantly, however, the passage of National Disaster Management Act of 2005 has made progress in mainstreaming disaster management into development planning by requiring

municipal corporations to address disaster management in revised city development plans. It also required states to establish a state disaster management authority, in effect establishing a multilevel institution for disaster risk management. The focus, however, remains largely on relief and rehabilitation rather than long-term or anticipatory climate resilient development (Ahmed and Fajber, 2009).

3.4 Climate Adaptation Planning in Cities

Non-state institutions have been active in climate adaptation planning across India. This includes the Rockefeller Foundation, the German Society for International Cooperation (GIZ), the United Nations Development Programme (UNDP), and ICLEI—Local Governments for Sustainability. Cities have increasingly been partnering with these and other philanthropic institutions, development agencies and transnational networks to conduct climate vulnerability assessments, facilitate stakeholder engagement strategies, and draft state climate action plans and city resilience strategies. Because Indian cities are prohibited from directly receiving funds from non-state bodies, such initiatives tend to take the form of pilot projects, technical support and capacity building (Revi, 2008). These interventions give valuable direction for climate action, but given their funds and duration, they also run the risk of losing impact upon completion (Sharma and Tomar, 2010). Moreover, they may introduce programmatic biases that influence local conceptions of climate adaptation.

Some cities have secured funding from domestic urban development programs, such as the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), although these are not explicitly linked with climate vulnerability or risk mitigation (Revi, 2008; Sharma and Tomar, 2010). This large-scale intergovernmental transfer system provides reform-linked grants to urban local bodies to upgrade the urban infrastructure and basic services. The reform agenda focuses on improving fiscal authority and governance of urban local bodies to achieve development objectives, which have indirect benefits for climate adaptation by reducing social vulnerability.

Cities have also taken advantage of institutional mechanisms presented through the National Action Plan on Climate Change, which explicitly concern climate change mitigation and adaptation. This includes the National Mission on Sustainable Habitat, the National Solar Mission, the National Mission for Enhanced Energy Efficiency, the National Water Mission and the National Mission on Strategic Knowledge for Climate Change (Atteridge et al., 2012). However, these missions tend to focus on climate change mitigation rather than adaptation and – with few exceptions – do not yet have committed funding.

Figure 4. Map of Cities in India by Population Rank



(Source: ESRI World Data)

3.5 Case Selection

The complexity of fiscal and policy frameworks for climate adaptation in India presents a major challenge to taking action at the city level. It is important to understand how cities might access and use available funds to navigate this challenge, and work to reduce their vulnerability to climate change. As such, this research is framed by two key questions: (1) How can cities in India draw upon different sources of funding to support local adaptations to climate change? (2) How might the urban finance system affect the implementation of climate adaptation strategies in these cities?

To address these questions, this research develops a case study on Surat, a coastal city in the western state of Gujarat. Surat was initially selected based on the presence of multiple climate risks as well as the involvement of external actors in climate adaptation planning. Key climate risks include the increasing incidences of river flooding due to more intense rainfall, as well as rising temperatures, sea level rise, storm surges, and water scarcity. It already experiences significant flooding almost, with particularly devastating impacts in 2006 and 2013. Since 2008, Surat has received extensive support from the Rockefeller Foundation's Asian Cities Climate Change Resilience Network to develop a climate resilience strategy and implement pilot projects. Chapter 4 provides more details on how this support has been used.

More importantly, the city is among the handful of examples in India where climate adaptation is being operationalized at scale. This process has involved a number of actors and funding sources, both public and private, each with distinct ways of framing and addressing the risks and vulnerabilities. While the adaptation planning process was externally initiated, Surat has taken steps to institutionalize climate adaptation planning through the establishment of a public trust. As such, Surat is an ideal setting for a case study analyzing the intersection of policy agendas in funding for climate adaptation.

Figure 5. Actors involved in Climate Adaptation in Surat and India at Large

	Government Bodies	Multilateral and Bilateral Aid Agencies	Civil Society	Philanthropy	Private Sector	Research Organizations
International	United Nations Agencies	Asian Development Bank	World Wildlife Federation	Rockefeller Foundation	Foreign direct investment	ISET
National	Government of India	DFID, GIZ	-	-	Taru Leading Edge	TERI, IRADe
Sub-national	Government of Gujarat	-	City Managers Association Gujarat	-	-	CEPT University
Local	Surat Municipal Corporation; Surat Urban Development Authority	-	ICLEI-Local Governments for Sustainability	ACCCRN	Chamber of Commerce	CSS, SVNIT

Surat has long prided itself on being an important commercial center in the region. Its port access and proximity to Mumbai and Ahmedabad have attracted a number of small and medium-sized industries in textile manufacturing, trading, diamond processing, and dyeing, as well as major chemical, petrochemical, and natural gas-based industries. The robust local economy has made the city an attractive destination for both national and global investment, while the promise of employment has attracted a steady stream of migrant labor from rural areas. As a result, it has experienced unprecedented rates of economic and population growth over the past five decades, with one of the country’s highest gross domestic products and 62 percent decadal population growth (SMC, 2012).

The city is held in high regard for its urban management due to its strong revenue base and relative cleanliness. However, this was not always the case: the city was infamous for its extremely unsanitary conditions that contributed to a plague outbreak in 1994 (Dutt et al., 2006). The epidemic served as a major turning point in environmental consciousness and urban governance in Surat. In response, municipal officials undertook major efforts to improve sanitation and public health: they invested in a health surveillance system, expedited the construction of new sewage and water infrastructure, and decentralized health monitoring services to the district level (Bhat et al., 2013). Moreover, the municipal corporation’s structure shifted from a vertical hierarchy to a more devolved structure across 38 election wards,

grouped into seven administrative zones. The result was a remarkable transformation in the quality and administration of city services. Surat's effective response to the plague outbreak demonstrates the commitment of its leadership, from which climate adaptation efforts might benefit as well.

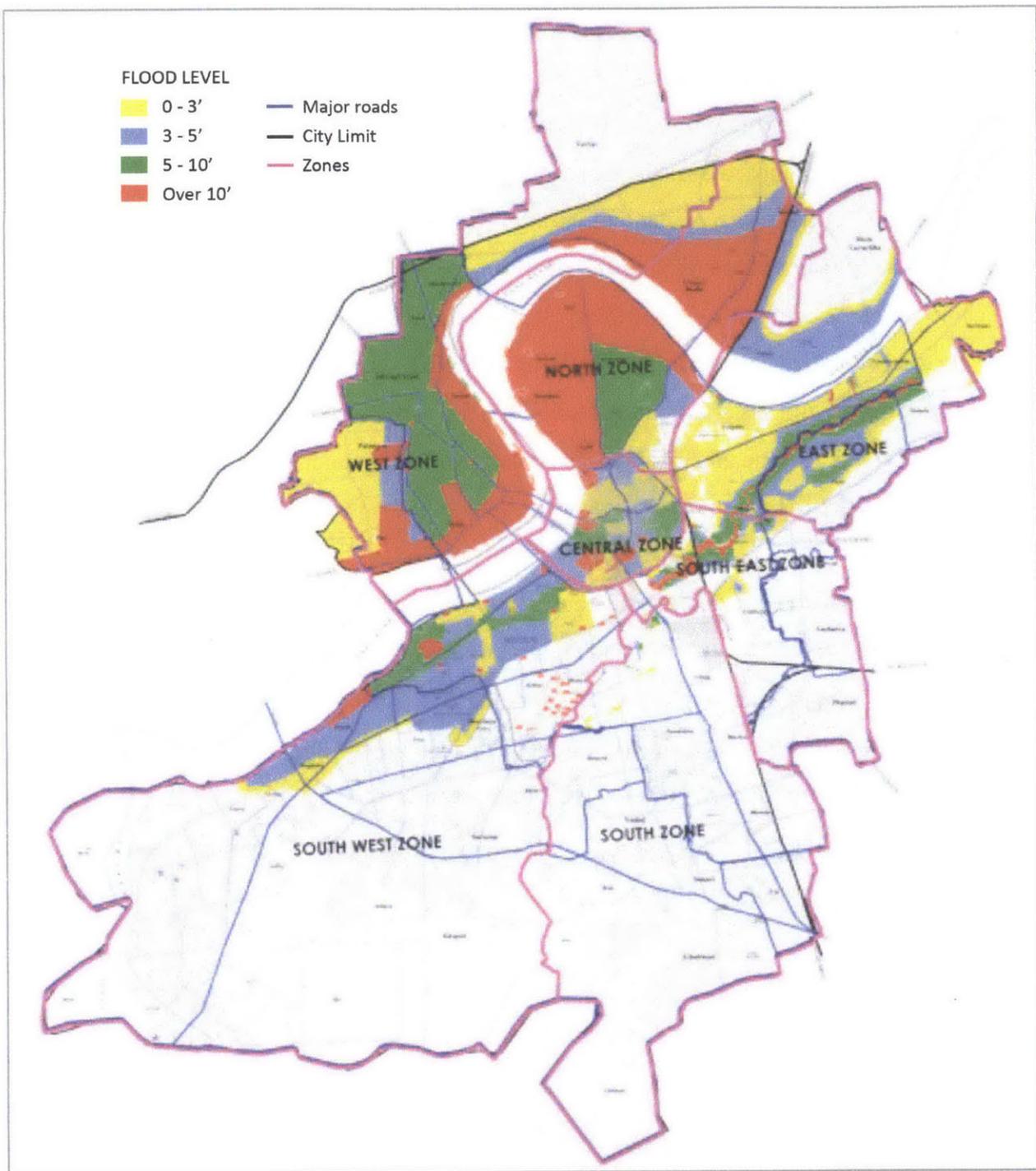
Despite this unique history, Surat is fairly representative of second-tier cities across India. First, it faces rapid urbanization and economic growth challenges that are characteristic of these cities. With a metropolitan population of nearly 4.5 million and a decadal growth rate of 62 percent, Surat is among the largest and fastest growing cities in India (Bhat et al., 2013). Fiscal constraints make it difficult to provide adequate levels of basic services and urban infrastructure to its growing population. Even so, its well-developed textile, diamond and petrochemical industries have made it an important trade center in Gujarat – one that attracts a steady stream of migrant labor (SMC, 2012). Second, Surat struggles with the disparities in social and economic development that are found across all Indian cities. Approximately 55 percent of the city's population lived in slum settlements in 2011, of which 80 percent are migrants (ACCCRN, 2011). As such, the vulnerability to climate change impacts varies spatially within the city. Third, Surat, as with other Tier II cities, is a major beneficiary of intergovernmental transfers and grants from the national and state governments for urban development purposes. Most notably, it has used JNNURM funds to support a number of urban infrastructure upgrading and poverty alleviation projects that indirectly contribute to climate resilience. These projects relate to water supply and sanitation, sewerage, solid waste management, road networks, and public transport. Surat has also received support for slum rehabilitation from the Government of India's Rajiv Awas Yojana scheme, and for urban development from the Government of Gujarat's Swarnim Jayanti Mukhya Mantri Shaheri Vikas Yojana. While Surat's experience in climate adaptation planning and implementation is unique, the case study aims to generalize its lessons and apply recommendations for second tier cities across India.

Figure 6. Major Cities in the State of Gujarat



(Source: ESRI World Data)

Figure 7. City of Surat during the 2006 Floods



(Source: Surat Municipal Corporation)

3.6 Methods of Data Collection

To address the research questions, I collected data from two key sources: qualitative interviews and public planning documents.

During January 2014, I conducted 12 in-person interviews with city officials in the Surat Municipal Corporation and members of the Surat Climate Change Trust (Appendix A). A core set of interviewees was identified through their participation in Surat's climate adaptation and development planning processes. Subsequent interviewees were identified through a selective snowballing technique, which enabled targeting key actors in the water supply, drainage, storm water, disaster management and financial departments in the Surat Municipal Corporation. The choice to focus on a narrow sample of interviewees was practical. "Climate adaptation" and "resilience" are relatively new concepts in Surat, and are considered as highly specialized to a small subset of city officials and trustees. However, the narrow sample introduces a bias to the collected data; as such, the analysis focuses on actions and perspectives at the city level as opposed to those at the community-level or household-level in Surat.

The interviews with city officials and trustees began with acquiring verbal consent, and were mainly conducted in English. They ranged in duration from approximately 20 to 75 minutes. Predetermined interview questions helped to standardize the interviews, though modifications were frequently made, based on the individual being interviewed and the time allotted. All interviews were recorded with the permission of interviewees. The aim of the interviews was to understand the linkages between funding sources and projects related to climate adaptation, as well as motivations for pursuing these projects.

I also reviewed publicly available planning documents and reports from international, national, state and local government agencies (Appendix B). Where possible, I collected relevant planning documents from the Surat Municipal Corporation offices. This included the City Development Plan, town planning maps, and annual budget summaries between 2006-2013. Taken together, these documents provided important information about the sources of public finance being used in Surat to operationalize climate adaptation.

3.7 Methods of Data Analysis

After conducting the interviews, all recordings were transcribed. First, I used the diagram presented in the theoretical framework (Figure 2, Chapter 2) to broadly organize information collected from the interviews. This helped to understand the wide range of types and sources of funding that support and shape climate adaptation in Surat. Second, I used various planning documents to better understand the policy objectives associated with funding sources, the types of financial resources available to cities, and how these resources were used at the city level. Third, I read the interview transcripts several times to identify initial themes: stated motivations and priorities in municipal government, attitudes toward climate resilience, availability of funding sources, and challenges to moving forward with climate adaptation. These themes helped to develop categories that were then developed into more refined themes that related to the fiscal context for urban development planning and climate adaptation. This qualitative data analysis was based on a general inductive approach, which helped to condense data collected from both the transcripts and planning documents into a summary format, and then to establish links between the main research questions and the summary findings (Thomas, 2006).

4: CLIMATE ADAPTATION IN SURAT

This chapter presents the research findings to build a narrative around climate adaptation planning and implementation in Surat through a financial lens. It begins with an overview of the city's vulnerability to climate change. It then describes local resource constraints and dependence on intergovernmental transfers and grant aid. Amidst this setting of high risks and constraints, it details the introduction of Rockefeller Foundation support in Surat, and traces the subsequent efforts to institutionalize the climate adaptation agenda. Finally, it describes how the city has creatively maneuvered fiscal constraints by drawing upon existing plans, programs and policies to support climate adaptation outcomes. Using the Surat case study, this chapter provides insights on the first research question regarding how cities in India can draw upon different sources of funding to support local adaptations to climate change.

4.1 Flood Vulnerability and Early Adaptation Efforts

The recurrent risk of flooding has shadowed Surat's trajectory of rapid population and economic growth. Located in the mouth of the Tapi River, the growing city has put enormous pressures on water management. Increasing industrial demand in the catchment area has reduced the river's flow, while urban development and siltation along the river have reduced its carrying capacity. This has required maximizing reservoir storage during the monsoon season, which can be precarious. Toward the end of the monsoon, when the reservoir is already filled to its maximum capacity, any increase in the inflow created by severe rainfall events forces the managers of the Ukai dam to release a high volume of water within a short period of time (Jagdish Thadani, 23 January 2014). The result is urban flooding in Surat.

Compounding this precarious situation, Surat is highly vulnerable to climate impacts from sea level rise, peak river flow discharges, increased and erratic precipitation, local creek flooding, and related vector-borne diseases (ACCCRN, 2011). Between 1949 and 1979, the natural flood occurrence was once every four years (Bhat et al., 2013). Since 1979, there have been at least six major floods, among which the 2006 floods stand out. During this event, approximately 75

percent of the city area was inundated for four days, resulting in hundreds of deaths and vector-borne diseases, as well as major disruptions to the city's economy (Bhat et al., 2013).

This event heightened consciousness of flood risks and the need for local action, leading to a range of investments in adaptation measures by public and private sector actors (C.Y. Bhatt, 16 January 2014). Since the 2006 floods, "the high flood level is considered first in any planning process by the city, and then the plans are made accordingly" (Debasish Basak, 18 January 2014). Apart from these procedural changes in planning, the city made institutional changes to manage disaster risk overall: it developed a more elaborate Disaster Preparedness and Municipal Response Plan, with technical assistance from the Gujarat State Disaster Management Authority. The new micro-level approach details prevention and response protocols at the *ward* level in addition to the city level during disaster events, with a particular emphasis on flood risks (C.Y. Bhatt, 16 January 2014).

Furthermore, the city invested in infrastructure upgrading to protect against losses from future flooding. With financial support from the Gujarat State Irrigation Department, Surat strengthened embankments along the Tapi River to better withstand moderate discharges from the Ukai dam upstream. To help protect against extended disruptions to economic activity in future floods, the South Gujarat Chamber of Commerce funded education and awareness efforts among its members – including nearly 100 associations of trade, professional, industry and organizations in the metropolitan region – and created a database of their assets to ensure that insurance claims were quickly settled (Kamlesh Yagnik, 17 January 2014). While these early efforts in Surat were not motivated by an explicit understanding of climate risks, they demonstrate a vested interest among public and private actors in improving the resilience of individuals, infrastructure and organizations to the very tangible threat of flood disasters.

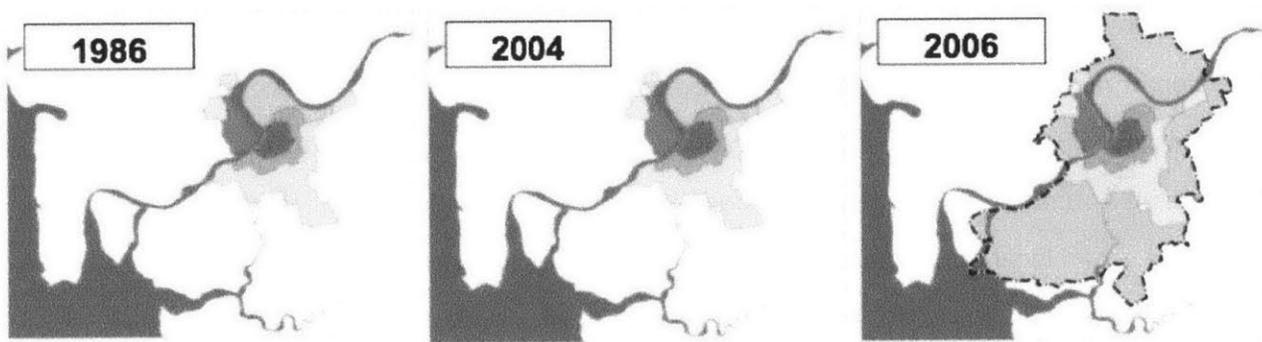
4.2 Infrastructure Deficits and Municipal Finance

Also in 2006, Surat's city limits expanded threefold, from 112 to 326 square kilometers (Figure 8). As the city extended along both banks of the river and outwards toward the sea, the Surat

Municipal Corporation was faced with even more significant challenges in providing adequate urban infrastructure. Increasing urbanization and rising incomes inflated demand for larger and better quality infrastructure (Debasish Basak, Personal interview, 18 January 2014).

Simultaneously, slum settlements along tidal creeks, riverbanks, between embankments and other drainage lines became home to growing numbers of migrants arriving to the city in search of work (ACCCRN, 2011). As the city grew, so did its vulnerability to flooding.

Figure 8. Expansion of City Limits

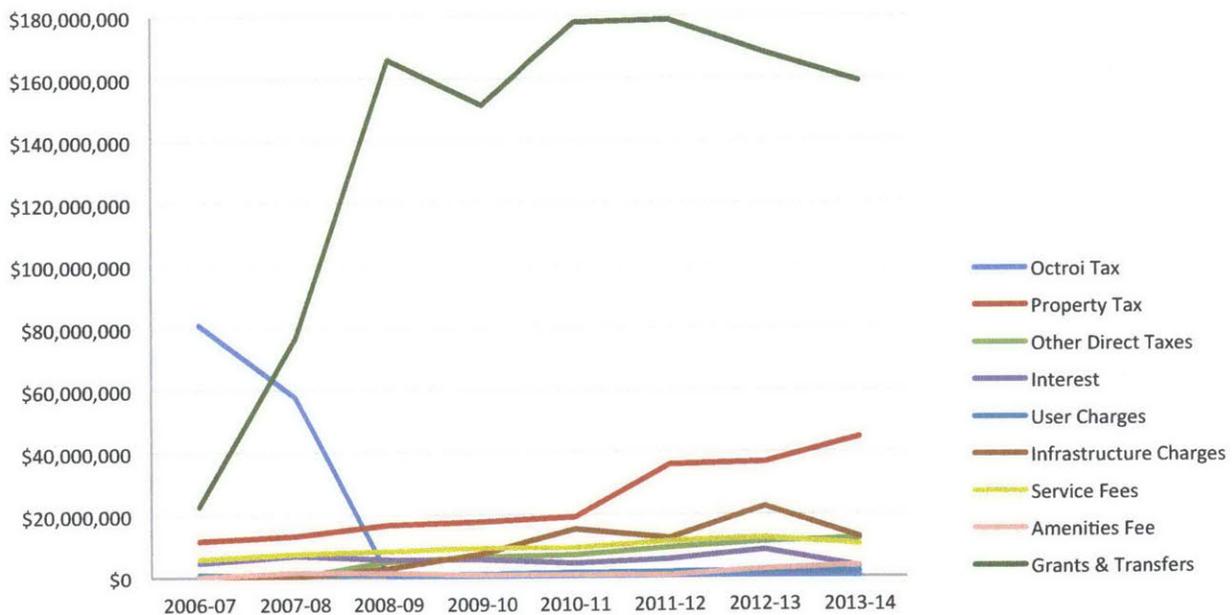


(Source: ACCCRN)

Recognizing the challenges created by rapid urbanization and constraints in local resources throughout the country, the Government of India initiated the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) at the end of 2005. The first phase of the seven-year intergovernmental transfer scheme provided matching grants for two missions – urban infrastructure and basic services for the urban poor – in Surat and 64 other participating urban local bodies. Transfers from the central government were made conditional upon the implementation of governance and fiscal reforms by urban local bodies, parastatals, and state governments. These reforms, if implemented fully, had potential to dramatically change the ways in which urban local bodies function – by improving transparency and accountability, increased financial viability, introduced a focus on improving lives of the urban poor. The ambitious intergovernmental transfer scheme envisioned the development of “economically productive, efficient, equitable and responsive cities” (MoUD, 2011). For Surat, JNNURM offered a critical opportunity to address its growing infrastructure deficit (Ashwin Taylor, 17 January 2014).

To access JNNURM funds, the Surat Municipal Corporation committed to a major restructuring of its revenue base. One particularly sweeping fiscal reform taken by the Government of Gujarat was the abolishment of the Octroi tax in 2007, which had been a principal revenue source for municipal corporations in the state. Levied at municipal boundaries on all incoming goods, the tax had long been criticized for being retrogressive, creating traffic congestion, and having negative effects on local trade and industries (Garg, 2007). Even so, it had generated between forty and fifty percent of municipal income (Figure 9). A second fiscal reform at the local level required increased transparency in property tax administration through updating property records and guidance values (MoUD, 2011). The shift to area-based property tax and revision of property tax rates have produced marked increases in Surat’s revenue stream. These reforms were partially initiated in 2008 but were not fully implemented until revisions in 2011, producing a substantial increase in property tax revenues (MoUD, 2011). Third, JNNURM required urban local bodies to levy reasonable user charges and fees to ensure full cost recovery for improvements in urban infrastructure and services. The reform has likewise contributed to increases in locally generated revenues in Surat.

Figure 9. Revenue Income in Surat Municipal Corporation, 2006-2013 (in USD)



(Source: Surat Municipal Corporation Annual Budget Data)

While reforms in property tax and user charges have helped to improve revenue collection in Surat, local revenues are used largely for regular operations and maintenance (O & M) (Figure 10). For major capital expenditures, the city has overwhelmingly relied on fiscal transfers from the national and state governments since the loss of the Octroi tax (Ashwin Taylor, 17 January 2014). The implication is diminished fiscal autonomy in fulfilling basic mandates, much less pursuing climate adaptation and other local priorities.

Figure 10. Revenue and Capital Expenditures of the Surat Municipal Corporation, 2013-14

Revenue Expenditures (USD)		Capital Expenditures	
General & Administrative Overhead	\$131,180,583	Roads & Transportation	\$135,765,698
Electricity	16,751,865	Buildings	39,208,054
O & M Roads & Transportation	15,067,605	Plants Machinery & Equipment	33,009,620
Service & Program-related Expense	12,068,218	Water Supply	21,015,467
Grants, Contributions	11,905,643	Sewerage Lines	14,193,027
Consumable Stores	3,538,725	Stormwater Drainage Lines	9,617,371
O & M Plants, Machinery, Equipment	2,927,951	Land	7,682,795
O & M Building	1,765,427	Public Places	6,404,939
O & M Sewerage & Drainage	1,150,777	Street Lights & Cables	2,644,410
O & M Public Places	895,032	Office Equipment	2,382,655
O & M Water Supply	786,341	Miscellaneous Fixed Assets	2,317,297
Financial Charges	589,158	River Embankment Scheme	1,065,392
Prior Period Expenses	219,703	Vehicles & Transportation Equipment	859,946
Upkeep of Livestock	160,850	Other Drainage Lines	737,989
O & M Furniture, Fixture, Fittings	67,355	Furniture, Fixture, Fittings	560,321
Maintenance of Land	48,010		
R & M Office Equipment	34,317		

4.3 Introduction of “Climate Resilience”

Surat was selected as one of the pilot cities for the Rockefeller Foundation’s Asian Cities Climate Change Resilience Network (ACCCRN) in 2008, due to its vulnerability to flooding, as well as the strength and quality of the local government, private sector and civil society partners (ACCCRN, 2011). ACCCRN introduced the concept of climate change to Surat for the first time, and offered a framework for addressing what were already high-priority issues in the city. One interviewee recalled,

“We had no clue about what is climate change, what is resilience, mitigation or adaptation. Those words were alien to us... When we met these ACCCRN people, for the first time we talked about climate change. And then we realized that – there are certain things that are happening – it could be because of climate change” (Kamlesh Yagnik, 17 January 2014).

The transnational network also introduced a potential new source of direct financial and technical support to Surat. Having recently emerged from a devastating flood disaster and coping with the loss of a large proportion of its revenue income, the city very reasonably welcomed the support.

Attached to this new funding source was a clear policy agenda in support of adaptation to climate change. Between 2008 and 2014, ACCCRN disbursed nearly \$2.8 million in medium-sized grants to the local consulting agency and implementation partner in India, Taru Leading Edge. These funds were dedicated to the development a citywide climate resilience strategy and implementation of pilot adaptation projects (Bhat et al., 2013). ACCCRN’s objective is “to measurably enhance the resilience of participating cities’ institutions, systems and structures to current and future climate risks, and through this, measurably improve the lives of poor and vulnerable people” (Rockefeller Foundation, 2010). The network’s conception of “climate resilience” is related to but distinct from the IPCC’s definition of climate adaptation.¹ It can be understood as the capacity of individuals, institutions and systems to respond to the impact of a changing climate while continuing to function regularly and prosper (Rockefeller Foundation, 2009). Resilience results in the following characteristics: (1) a high degree of flexibility in responding to climate change; (2) a high degree of redundancy of processes, capacities, and response pathways to allow for partial failure without collapse; (3) planning in the preparation of expected impacts and possible failures; (4) high degree of diversity of response and recovery options and a high level of decentralization; and (5) cross-sectoral coordination and collaboration to respond to climate-related impacts (Rockefeller Foundation, 2009).

¹ The IPCC defines adaptation as “an adjustment in natural or human systems in response to actual or expected climatic stimuli (variability, extremes, and changes) or their effects, which moderates harm or exploits beneficial opportunities” (IPCC, 2014).

Developing the climate resilience strategy brought together a number of stakeholders across public, private and civil society lines through an ACCCRN-supported process between 2009 and 2011. In addition to a series of one-on-one consultations, regular city advisory committee meetings facilitated the exchange of information regarding climate change risks and vulnerabilities facing the city. The development of the climate resilience strategy also included risk assessment and sector studies, whose costs were shared by the Surat Municipal Corporation, the South Gujarat Chamber of Commerce and Industry, and local academic institutions, including SVNIT and the Center for Social Studies (Kamlesh Yagnik, 17 January 2014). All of the gathered information was integrated through risk to resilience workshops, in which stakeholders identified short, medium and long-term resilience strategies that build on current and planned initiatives across municipal sectors. After brief public consultations, the Surat Municipal Corporation published the Surat City Resilience Strategy in 2011 (ACCCRN, 2011).

Furthermore, ACCCRN channeled seed funding from the Rockefeller Foundation for a variety of pilot projects. This included information gathering and knowledge dissemination measures, or non-structural adaptations. For instance, the Urban Health Climate Resilience Center (UHCRC) was established with the objective of strengthening urban health management. The center has helped to forge linkages between academic institutions and the municipal corporation:

The UHCRC is headed by the Surat Municipal Corporation's Health Department. But research is not their job; they don't even find time to read such things! But our job is to find such things, and to put it in a way that they [municipal officials] can grab it. And also, to do advocacy so that it [public health research] is accepted and put into the system (Dr. Vikas Desai, 17 January 2014).

Specific activities include conducting evidence-based research on public health and climate adaptation issues, as well as improving vector-borne disease surveillance and operating procedures in Surat. An interviewee described these activities in detail:

UHCRC is focusing only on Surat. We are analyzing their secondary data, observing their operations, and trying to identify the gaps in the public health system. We are trying to provide research to improve the system [...] We need to be on high alert because we are always at high risk. We are planning to share our experience with other cities, and learn from them. It is mutual learning. That is the vision. (Dr. Vikas Desai, 17 January 2014).

Another information-oriented adaptation was the development a spatial database of vulnerable populations within the city that may require critical care during flood-related and other emergencies. Two ACCCRN-supported projects took the form of design competitions: one for flood-resilient housing and another for cool roofing and passive ventilation options. These competitions intend to raise awareness among professionals and local communities, as well as to generate experimentation in policy, planning and design. From the town planner's perspective, however, it seems that momentum from the competitions has not been sustained:

The competition was 2-3 years back. 2011. It had a very good impact on the municipal corporation, the Surat Urban Development Authority, and also Gujarat and India. There was an awareness. But honestly I don't know what shape it is in now [...] We took a pilot area, and hoped that such concepts and ideas [about climate resilience] would be taken into consideration in our planning (Debasish Basak, 18 January 2014).

Finally, Rockefeller Foundation funding supported the development of technological adaptations, including the urban services monitoring system to improve information dissemination and mitigate urban service grievances, particularly during flood events. It also includes the end-to-end early warning system, which aims to improve reservoir operations and city preparedness for improved flood management through increased coordination and prediction capacity (Jatin Shah, 16 January 2014).

Overall, these Rockefeller projects address flood vulnerability and public health risks due to climate change, and place much less emphasis on addressing rising temperatures and drought. This is unsurprising in light of the city's previous experiences with severe flooding and the plague. Furthermore, many of these climate adaptation measures are non-structural, focusing more on planning, civic engagement, coordination, awareness and design, and less on infrastructure and buildings.

4.4 Institutionalizing Climate Adaptation Efforts

The Surat City Climate Resilience Strategy did not delegate institutional responsibilities or legislative authority, nor did it outline an explicit financial strategy for implementation. Given

that support from the Rockefeller Foundation through ACCCRN was set to conclude during the 2013-14 fiscal year, these issues required immediate attention.

In an effort to institutionalize the climate adaptation planning processes initiated by ACCCRN, the city advisory committee was legally established as the Surat Climate Change Trust (SCCT) in June 2012.² According to one interviewee, “Before this group had been loosely bound and very unorganized – very informal way in which we were meeting” (Kamlesh Yagnik, 17 January 2014). With the formation of the city level public trust, the committee members – including representatives from the Surat Municipal Corporation, the South Gujarat Chamber of Commerce and Industry, local academic institutions and state-level agencies, such the Gujarat State Disaster Management Authority and Narmada, Water Resources and Water Supply Department – became trustees, with formalized roles in the climate adaptation planning process (ACCCRN, 2011). The trustees believed that building the city’s climate resilience was critical to its safety and continued economic development, as well as for raising its profile in the international arena (Kamlesh Yagnik, 17 January 2013; Eric Chu, Personal communication, 2 April 2014).

The establishment of the SCCT served a number of objectives related to stakeholder participation, civil society engagement, and financial sustainability. According to its mission statement, it offered a way to provide “a sustainable and neutral platform which could bring key institutions together to identify integrated solutions for complex urban problems” (ACCCRN, 2012). As such, it demonstrated the commitment of municipal officials to collaborating with private sector actors and civil society on key issues. SCCT also served an institutional purpose for managing the various activities and actors involved in climate change. It would support and coordinate resilience-building interventions, by networking with key government departments, local institutions and technical experts in the city. Importantly, SCCT also served a financial purpose, as explained by a technical consultant from Taru:

² The Bombay Public Trusts Act, 1950, regulates public religious and charitable trusts in the State of Gujarat. The Act applies to all communities and all public trusts defined in the Act, irrespective of the size of their income. It requires every public trust to be registered and to audit annual accounts.

Rockefeller Foundation has given SCCT some seed money for the Urban Health Climate Resilience Center, the early warning system, the cool roofing and passive ventilation, and so on. All these projects were started with seed money. But for the long-term sustainability, we want more funding [...] Surat Municipal Corporation cannot get directly the foreign money. But for that purpose, we have established the Trust (Mehul Patel, 18 January 2014).

As an entity autonomous from the Surat Municipal Corporation, SCCT can bypass fiscal and bureaucratic constraints and solicit funding support from external sources. While it has not yet begun to do this, it will become essential as Rockefeller Foundation's seed grants for pilot adaptation projects expire at the end of 2014.

In the interim, SCCT has received earmarked funds from the Surat Municipal Corporation to support climate change projects, amounting to approximately \$330,000 per fiscal year since 2013. This represents a small fraction of the amount needed to address climate risks, suggesting its importance as a symbolic gesture rather than practical allocation. Under the supervision of the City Engineer and the Municipal Commissioner, SCCT will use these funds to complement existing urban infrastructure upgrades and service enhancement efforts, in particular for those interventions that increase resilience of vulnerable sectors and communities to the adverse impacts of urbanization and climate change. This institutional arrangement affords flexibility in financing and implementing priority climate adaptation measures:

Because the head of the SCCT is also our municipal commissioner, he can align priorities between SMC [Surat Municipal Corporation] and SCCT. So whatever project we would like to do for the energy conservation, we are using for both climate change as well as in the administration of the SMC. When there is need of more funds, then at that time SMC will give the fund to SCCT (Jatin Shah, 16 January 2014).

SCCT, though established as an independent public entity, is strategically situated to work alongside the Surat Municipal Corporation. As such, it will be able to leverage the city's initial investments in climate adaptation, namely by drawing in private finance and international funding streams.

4.5 Investing in Climate Adaptation

Much of Surat's climate resilience strategy builds on interventions already taking place under planned investments by the city, state and central governments. As such, the city's investments

in climate adaptation measures draw from funding sources that are linked with policy agendas related to urban development and disaster risk reduction. The following section discusses Surat's investments in adaptation measures by funding source.

Government of India programs

Jawaharlal Nehru National Urban Renewal Mission (JNNURM)

Surat has taken full advantage of JNNURM to finance vulnerability reduction measures. Intergovernmental transfers from the Ministry of Housing and Urban Poverty Alleviation and the Ministry of Urban Development³ have totaled nearly \$203 million since 2006. These funds have leveraged limited local resources to fund a number of critical infrastructure projects that help to reduce vulnerability of the city's population. Key among these projects was the slum rehabilitation and relocation away from the low-lying, flood-prone areas along the Tapi River. These slums were repeatedly submerged in annual floods, incurring major losses for the slum dwellers as well as expenses for emergency responses. Relocation represented a long-term strategy to decrease flood vulnerability of the slum population, while rehabilitation aimed to improve the quality of basic services for the urban poor. As such, central government funds allocated for urban development were used for both poverty alleviation and climate resilience objectives. Descriptions of the project by municipal officials reflect its dual objectives.

According to the City Engineer,

The Surat Municipal Corporation is doing a lot of work on the climate change. The most vulnerable part of the city is the bank of the river. That we have completely evacuated! We have shifted all slum dwellers along the river (Jatin Shah, 23 January 2014).

For the same rehabilitation project, a drainage engineer in the Surat Municipal Corporation frames the key objectives alternatively:

We are doing very good things for poverty alleviation. We have constructed 45,000 pukka [permanent] houses for the slum dwellers. We have reduced our slum population from 18 percent to 8 percent since JNNURM started (K.S. Patel, 17 January 2014).

Bundling together poverty alleviation and climate resilience objectives may also be politically advantageous. The touted co-benefits of slum relocation for climate resilience overshadow

³ Since 2004, the Ministry of Housing and Urban Poverty Alleviation functions separately from the Ministry of Urban Development. The two ministries have been merged and bifurcated multiple times since 1952.

considerations of equity. When asked about the quality and adequacy of pukka houses or the willingness of slum dwellers to move, interviewees insisted that they were an improvement from previous conditions. One interviewee described,

These huts in the riverbed were there for many years. They had not imagined that they would be moved. Even the people of the city of Surat had thought it was a permanent structure. In 2006, the whole slum was totally submerged. That was a huge loss for them in assets and property. With the help of the government scheme [JNNURM], we have constructed new dwelling units. The huts that were prone to flooding have been shifted (C.Y. Bhatt, 16 January 2014).

The emphasis on climate resilience thus appears to have eclipsed attention to the potentially disruptive social and economic impacts of slum relocation on the affected communities.

Government funding from JNNURM has also allowed Surat to strengthen and extend its drainage, sewerage and solid waste management systems. Given its downstream location, the city is vulnerable to increased runoff and water logging due to the increased frequency and intensity of precipitation events. Investments in new construction, renovation and upgrades of critical infrastructure have significantly reduced flood losses, enhanced operations, and prepared the administration to ensure quick recovery from major flood events (ACCCRN, 2011). Examples include an automated monitoring system in water treatment plants and pumping stations, leakage mapping of the water supply network, the purchase of submersible sewage treatment pumps, construction of sewage treatment plants, and expansion of the storm water drainage network. In line with the Surat City Climate Resilience Strategy, several interviewees suggested that these infrastructure development projects qualify as climate adaptation. They contribute to overall urban resilience by improving the quality of “lifeline” services, by hardening existing infrastructure to withstand flood risks, and by creating redundancies in the urban system to protect against failure. According to the Town Planner,

“We cannot isolate climate resilience activities. Physical activity that is taking place, like water supply provision throughout the city – it’s a part of the climate thing. Then there are energy conservation schemes that are going on; there are energy audits also. These are the things where you reduce the financial constraints, and at the same time, improve the operation and quality of urban services” (Debasish Basak, 18 January 2014).

JNNURM has provided a cost-effective way for Surat to pursue climate adaptation objectives through broader urban development efforts. As the town planner’s remark indicates, the two policy agendas are conceived as inseparable in practice. The strategy of intertwining policy

objectives to maximize use of available public finance extends beyond JNNURM to a several other funding sources.

Rajiv Awas Yojana

Rajiv Awas Yojana, a central government scheme introduced as JNNURM's first phase came to a close, provides reform-linked grant funding. Supported by the Ministry of Housing and Urban Poverty Alleviation, it envisages working toward a "slum free India" with inclusive and equitable cities between 2013 and 2022. To this end, it channels funding from the Government of India through the Government of Gujarat to provide housing and improvement of basic civic infrastructure and social amenities in selected slums through in-situ rehabilitation, affordable housing construction and interest subsidy schemes for low-income groups. This funding is conditional on a number of reforms, including (1) commitment to assign long-term lease rights to slum dwellers, (2) reservation of 15 percent of the residential floor space index for low-income groups, and (3) earmarking 25 percent of the municipal budget to provide basic services for the urban poor (MHUPA, 2012).

Surat has received approximately \$4.5 million through the Rajiv Awas Yojana, and is currently using these funds for city mapping and administering slum surveys in informal settlements at Bhimnagar, Kamrunagar and Ektanagar. The collected information on vulnerable populations in the city will help to develop a Slum-Free City Plan, which will contribute to the Surat's climate resilience efforts according to the Town Planner. He explained, "When we talk about environment, the urban poor cannot be separated. It is integrated. Urban poor is again a part of the climate change resilience theory" (Debasish Basak, 18 January 2014). This understanding suggests the strong influence of the Rockefeller Foundation's approach to climate resilience, which emphasizes the disproportionate vulnerability of marginalized communities to climate change risks. This influence might have been further internalized by the ACCCRN-supported pilot project, a spatial database of vulnerable populations in the city.

While Surat is still in mapping and surveying stages, Rajiv Awas Yojana will also provide opportunities for public-private partnerships in the future. To incentivize redevelopment of slum areas on government land, the Surat Municipal Corporation can transfer development rights (i.e., additional floor space index) to help developers earn revenues from another commercial project elsewhere in the city. Rajiv Awas Yojana thus offers a unique mechanism to expand Surat's poverty alleviation efforts, which, in reducing the social and physical vulnerability of marginalized populations, may have complementary benefits for climate resilience. It remains to be seen whether and how this mechanism will be utilized.

National River Conservation Plan

In 2012, Surat secured about \$33.5 million in grant aid from the National River Conservation Plan (NRCP) for the rehabilitation of the Mindhola Creek. Launched by the central government's Ministry of Environment and Forests, the NRCP aims to improve water quality of major rivers through a cost sharing arrangement between the central and state government (70 percent: 30 percent). It supports river pollution abatement efforts across India through interception, diversion and treatment of sewage and low cost sanitation works on riverbanks. It also supports riverfront development works, public awareness and participation campaigns, and river conservation research. The guidelines issued by the Ministry of Environment and Forests acknowledge that while the Ministry of Urban Development's JNNURM has many similar components as NRCP – particularly with regards to wastewater and solid waste management – the two schemes have not been coordinated across ministries.

Surat plans to use NRCP funds for the rehabilitation of the Mindhola Creek. This effort will include extending sewage collection pipelines and pump stations to under-served areas to reduce local pollutants. In addition, it will "beautify" two tributaries of the Mindhola, the Mithi and Kankara, adding cycle tracks and trees to buffer flood damages and the possibility of encroachment. Finally, the funds will be used for dredging the creeks and constructing gabion pitching, which help to maintain the carrying capacity and to manage flood risks.

According to a project engineer for the Mindhola Creek rehabilitation, this multi-part project was initiated in response to current and projected climate risks.

This is a high rain intensity area. So what is happening, it is because of climate change. The rain intensity has quite increased, and water is coming from outside of the city into the creeks. The lower-income residents nearby that area will get affected in the flood. Last time [in 2006], the condition was so serious the water was retained for 3-4 days [...] On River Tapi, there is a control called Ukai dam. But on this Mindhola creek, there was no control mechanism there. So that we have planned: to provide gabion pitching and help retain water (Bhairav Desai, 16 January 2014).

In framing the investment as being climate-motivated, the project engineer expands the expected benefits of climate adaptation to include pollution abatement. "Climate change considerations are part of this project, because we are reducing pollution, which is a part of climate change" (Bhairav Desai, Personal interview, 16 January 2014). In effect, the project bundles a number of environmental objectives together to maximize use of the NRCP funding. This may undercut the effectiveness of adaptation measures: in employing urban development and disaster risk reduction tools, the Mindhola Creek rehabilitation project may not necessarily address the long-term risks associated with climate change.

State of Gujarat programs

Swarnim Jayanti Mukhya Mantri Saheri Vikas Yojana

Recognizing the constraints facing municipal corporations since the loss of Octroi tax, the Government of Gujarat introduced the Swarnim Jayanti Mukhya Mantri Saheri Vikas Yojana in 2011. The urban development scheme provides fiscal transfers for public infrastructure works in the largest municipalities in the state, including Ahmedabad, Surat, Vadodara, Rajkot, Bhavnagar, Jamnagar, Junagadh and Gandhinagar. Swarnim Jayanti allocations are not linked to reforms, unlike JNNURM or Rajiv Awas Yojana. Like JNNURM, however, they are project-based: municipal corporations must present project proposals to the state government for approval.

For the 2013-14 fiscal year, Surat was allocated \$33 million. However, this allocation changes from year to year, and the terms of disbursement can be modified at any time by the State government (UDD, 2013). Surat has used Swarnim Jayanti support to build upon JNNURM investments in water supply expansion, as well as for water recycling. The growing industrial

demand for water in Surat exceeds 100 million liters per day, which, combined with population growth and future variability in precipitation, puts major stress on the city's water supply. The state-funded tertiary treatment plant is considered to be an important measure to enhance climate resilience. It allows for the recycling of domestic wastewater, which – for cities with limited ground water recharge potential due to proximity to saline aquifers – is a desirable element of water management (ACCCRN, 2011). The result is “spare capacity” which is essential in meeting climate-induced scarcity periods. According to the deputy drainage engineer:

From a climate change point of view, first time what we are doing is reuse. Previously we were treating water and disposing into the Tapi River. Now we have planned to reuse [...] We will have spare capacity of the water that can be used in other areas (Bhairav Desai, 16 January 2014).

The water recycling initiative also contributes to cost-effectiveness of supplying water. As the City Engineer describes: “Tertiary treatment is not mandatory. But it looks to the availability of fund that is profit, as well as the conservation of water” (Jatin Shah, 16 Jan 2014). Moreover, it fosters economic development, a major priority among city stakeholders. “By serving this [tertiary-treated] water to industries, we can save our groundwater, we can save our reservoirs, and we can increase the business of this city so it can develop more, and in a faster way” (B.I. Dalal, 16 January 2014). The integration of climate resilience measures into state-funded urban development projects is thus justified by cost efficiency and economic development objectives.

Gujarat State Irrigation Department

The Gujarat State Irrigation Department provides grant aid for flood management in Surat. As the agency responsible for managing the state's water resources, it funds regular maintenance of the flood control infrastructure (C.Y. Bhatt, 16 January 2014). After the 2006 floods, it expanded the Surat Municipal Corporation's efforts to reinforce over 20 kilometers of embankments along the Tapi River. The Irrigation Department is also in the process of constructing a new 9-kilometer western embankment and a 365-meter eastern embankment along the Tapi River. The estimated \$5.8 million investment aims both to increase the river's carrying capacity and to reduce flood risks to neighboring communities (Jatin Shah, 23 January 2014). The project was initially conceived after the 2006 floods, but did not gain impetus until the 2013 floods (K.S. Patel, 17 January 2014). In discussing the embankment construction,

interviewees did not link these disaster risk management efforts to the city's climate resilience strategy. One explanation may be the city's limited flexibility in using these departmental funds for purposes outside of flood management. Another is the general lack of integration of disaster risk reduction and climate adaptation agendas at higher levels of government in India.

Outside of Surat, the Irrigation Department has been taking measures to reduce drought vulnerability and improve water security. In addition to promoting micro-irrigation systems and educating farmers, the state has transferred water from the water-rich areas of south Gujarat to water-scarce areas of north Gujarat, including Saurashtra and Kachchh (Kumar et al., 2010). It has also launched a massive program of decentralized groundwater recharge through water harvesting systems, though critics charge this has been ineffective and piecemeal solution to groundwater depletion problems (Kumar et al., 2008).

Gujarat State Disaster Management Authority

The Gujarat State Disaster Management Authority (GSDMA) provides grant aid for disaster management planning. GSDMA aims to make the state "economically vibrant, agriculturally and industrially competitive with improved standards of living and with a capacity to mitigate and manage future disasters." It acts as a nodal agency for supporting disaster management planning and research efforts; raising money for relief efforts; and maintaining hygienic living conditions (GSDMA, 2013). As with the Irrigation Department, GSDMA's financial support directly benefits cities like Surat but does not afford much flexibility. For instance, in 2009, GSDMA provided grants to cities with the specific purpose of establishing regional emergency response centers (C.Y. Bhatt, 16 January 2014). It also conducted flood vulnerability assessments for Surat and other major economic centers of Gujarat. These assessments outlined structural and non-structural measures for flood management, such as improved urban drainage in all sub-catchments, rezoning of high-risk areas, and flood-proofing buildings and infrastructure (GSDMA, 2013). Through these activities, GSDMA has demonstrated understanding of the linkages between urban development and disaster risk reduction. It is also

beginning to integrate climate change concerns, as well, chiefly by providing downscaled climate and hydrological information to support city development planning across the state.

Figure 11. Sources and Types of Funding for Climate Adaptation in Surat

Funder	Source	Funding Type	Objective	Amount	Adaptation Type
Rockefeller Foundation's ACCCRN	Philanthropic foundation	Grant aid	Climate resilience	\$2.8 million	Planning Technology Information
Jawaharlal Nehru National Urban Renewal Mission	National government	Fiscal transfer	Urban renewal, poverty reduction	\$203 million	Poverty alleviation Infrastructure
National Sustainable Habitat Mission ⁴	National government	Grant aid	Energy efficiency	-	Planning Infrastructure
National River Conservation Plan	National government	Grant aid	Pollution abatement	\$33.5 million	Infrastructure
Rajiv Awas Yojana	National government	Grant aid, PPP	Poverty alleviation	\$4.5 million	Planning
Gujarat Department of Climate Change	State government	-	Climate mitigation and adaptation	-	Planning
Gujarat Disaster Management Authority	State government	Grant aid	Disaster risk reduction	-	Planning Information Capacity building Relief and recovery
Gujarat Irrigation Department	State government	Grant aid	Flood control	\$5.8 million	Infrastructure
Swarnim Jayanti	State government	Fiscal transfer	Urban development	\$33 million ⁵	Infrastructure
Surat Municipal Corporation	Municipal government	Local revenues	Basic services	-	Planning Information Operations and maintenance
Surat Climate Change Trust	Quasi-public agency	Grant aid	Climate resilience	\$660,000 ⁶	Information Technology
South Gujarat Chamber of Commerce & Industry	Private	Grant aid	Education and awareness	-	Capacity building Relief and recovery

⁴ One of the 8 missions under the National Action Plan on Climate Change. Once approved, it will require urban local bodies to earmark funding for climate change mitigation and adaptation.

⁵ Amount allocated in 2012-2013. Figure does not reflect *total* amount from this source since 2011.

⁶ Total amount allocated from the Surat Municipal Corporation budget between 2013-2015

4.6 State Climate Action

As Surat has made investments in climate resilience over the past six years, there have been important policy developments at the national and state levels. The National Action Plan on Climate Change, introduced in 2008, legislated responsibilities for climate action to state governments. Several states, with help from multilateral and bilateral organizations, drafted state action plans. In Gujarat, the Chief Minister Narendra Modi demonstrated great enthusiasm for the issue, authoring a novel entitled “Convenient Action: Gujarat’s Response to the Challenges of Climate Change.” In 2009, he launched Gujarat State Climate Change Department, which was celebrated as “Asia’s first dedicated government department for climate change department” (Climate Change Department, n.d.). The Climate Change Department initiated a process to develop a comprehensive Gujarat State Action Plan for Climate Change that would coordinate mitigation and adaptation actions initiated under the national climate change missions. To this end, the department provided grants for a handful of mitigation and solar projects that fell under its purview. However, the state government never approved the draft State Action Plan for Climate Change. The fledgling department has consequently failed to launch any of the projects outlined in the plan – which included a climate change trust fund and statewide climate change impact assessment – despite being allocated \$18 million in the state’s annual budget (Dave, 2013).

In light of this setting, Surat’s efforts to institutionalize and invest in climate adaptation were locally situated and largely unlinked to broader planning efforts at the higher levels of government. While this has given the city great flexibility in pursuing local objectives, it may have negative repercussions for the long-term sustainability of some of its adaptation measures, as well as for their integration into regional adaptation strategies.

5: URBAN FINANCE AND CLIMATE ADAPTATION

This chapter focuses on the second research question regarding how the urban finance system in India – characterized by limited fiscal autonomy and a high degree of dependence on external funding sources – might affect the implementation of climate adaptation strategies in cities. Using the Surat case study, it begins by broadly discussing the effectiveness of adaptation outcomes that are supported by multiple sources of funding. It then examines how the urban finance system might enable climate adaptation in cities, albeit with tradeoffs. Finally, it considers the ways in which the urban finance system may be constraining adaptation efforts.

5.1 Adaptation Outcomes in Surat

Surat has marshaled funding from various sources to support its climate adaptation efforts. In part, this strategy has emerged from a context of fiscal constraints – created by constitutional mandates and fledgling reforms that have resulted in a dependence on intergovernmental transfers. To understand the broader implications of this urban finance system for climate adaptation in Indian cities, it is important to understand the extent to which this strategy has allowed Surat to address inherent vulnerabilities to climate change. While a comprehensive assessment of adaptation outcomes in Surat would be useful, it is beyond the scope of this thesis. Examples, however, can help to understand how Surat’s financing strategy has affected its implementation of climate adaptation. The following section focuses on two key adaptation outcomes in the city, flood risk management and institutional capacity.

The Surat City Climate Resilience Strategy highlights flood risk as a key climate vulnerability in the city. In light of the dramatic physical and economic losses from previous floods, the topic is of great importance to municipal officials and the business community, both of which were key stakeholders in the climate adaptation planning process. To support climate adaptation through improved flood risk management, the Surat Municipal Corporation has assembled grant aid from a number of sources: Rockefeller Foundation, national urban development and river conservation programs, as well as state disaster management and irrigation departments.

Specific outputs include the end-to-end early warning system, slum rehabilitation, embankments, storm water drainage, and flood vulnerability mapping. In light of the quick recovery from the recent 2013 floods, it seems that this array of structural and non-structural adaptation measures has positively contributed to Surat's capacity to manage the flood risk. One interviewee noted, "Restoration work [in 2013] was very less because of many of the things we did after 2006, like the relocation of riverbed hutments and the embankments" (C.Y. Bhatt, 16 January 2014).

However, Surat's apparent success in reducing flood vulnerability obscures equity and long-term efficacy considerations. When asked about the large-scale rehabilitation and relocation of flood-prone slum settlements to the outskirts of the city, several interviewees responded that the provision of permanent housing and basic services was a marked improvement for the affected communities. There was little acknowledgement of the potentially disruptive impacts of slum relocation on these communities. In addition, the strengthening of embankments and other flood control mechanisms may not only increase siltation and reduce carrying capacity, but also encourage further development of floodplain areas, thereby increasing overall vulnerability of the city. Likewise, the end-to-end early warning system allows the city to anticipate flood disasters, but does not necessarily reduce the flood risk itself. The technology constitutes a predict-and-respond strategy that, according to the Climate Resilience Strategy, aims to reduce economic losses and ensure business continuity. While the early warning system is a critical development for coping with recurrent flooding, a focus on such economic considerations may compromise a longer-term vision for adaptation that gives equal weight to social, environmental and economic considerations.

The Surat Climate Change Trust was established for the purpose of building the city's institutional capacity to manage climate risks. Initially funded by the Rockefeller Foundation through ACCCRN, the Trust has also received support from the Surat Municipal Corporation since 2013. As described in the previous chapter, its independent status as a public trust will allow the city to directly raise funds for adaptation purposes in the long run. However,

interviewees expressed some concerns about its actual capacity. According to one trustee, the trust is composed mostly of ex officio members whose main concern is not climate change. Several interviewed trustees deferred knowledge about climate change planning to other members of the trust, usually the City Engineer. Apart from these seemingly low levels of awareness and concern, the trustees' varying levels of commitment have resulted in constant delays in the planning and decision-making process. In effect, the Surat Climate Change Trust has not yet been able to "work with and guide the system" as envisioned, nor has it been able to articulate a long-term vision for strengthening climate adaptation efforts in the city (Dr. Vikas Desai, 17 January 2014). Another interviewee pointed to the trust's lack of managerial capacity, resulting in an extended dependence on ACCCRN's implementing partner, Taru Leading Edge, for technical assistance and decision-making support (Mehul Patel, 18 January 2014). These criticisms are telling, but must be understood in context: the Surat Climate Change Trust is a relatively new institution without precedent in Surat, and its role and responsibilities will likely evolve in the coming years.

Based on these examples, climate adaptation efforts appear to have been partially effective in reducing the city's vulnerability to climate risks and increasing its overall resilience. This finding warrants examining more closely how the urban finance system in India might shape climate adaptation outcomes in Surat and other cities.

5.2 Urban Finance System as an Enabler

Since the introduction of ACCCRN and the development of its climate resilience strategy, Surat has demonstrated success in implementing climate resilience measures despite severe constraints in local revenue authority. Although reforms in user charges and property tax have improved local revenue streams in Surat, climate adaptation in the developing country context requires substantial investments in infrastructure and service provision that are well beyond the capacity of even the best-run urban local bodies to generate. Out of necessity, the city has turned to external sources of funding to address climate vulnerabilities.

Embedded in a multi-level fiscal system, Surat has drawn upon financial and technical support across state and national levels of government as well as from civil society and the private sector to invest in building resilience to climate change. It initially drew upon support from the Rockefeller Foundation through ACCCRN, which brought together stakeholders representing various scales and sectors to catalyze a citywide planning process to develop a climate resilience strategy. In recognition of the limited nature of donor support, Surat institutionalized this interest and engagement in climate resilience by dedicating a budget line and establishing a public trust, whose independent status is designed to overcome regulatory barriers and access private sources of funding. Simultaneously, Surat has found complementarities in existing projects and programs supported by intergovernmental grants, including JNNURM and Swarnim Jayanti. Support from national missions and state schemes have enabled large-scale investments in infrastructure and service provision that contribute to overall climate resilience, and are advantageous even in the absence of climate change impacts.

Surat has demonstrated dexterity and entrepreneurialism in marshaling funds to support “no-regrets” measures that produce local benefits under all climate scenarios. Implementing the climate adaptation agenda in other cities across Gujarat and India at large, which face comparable fiscal constraints, may necessitate similar strategies. Given an overwhelming focus on urban development as a means for economic growth at the state and national levels, these cities will have to creatively link this new agenda to existing priorities, plans and programs.

5.3 Tradeoffs in Funding and Action

While intergovernmental transfers have enabled critical investments in climate resilience, they require tradeoffs in the types of adaptation measures taken. External sources of funding require urban local bodies to align their projects to the conditions outlined by national missions and state schemes. Seeing as JNNURM and Swarnim Jayanti have been among the key sources of funding for climate adaptation, urban development has been a major focus of the city’s climate adaptation efforts. The majority of Surat’s climate adaptation measures have prioritized vulnerability reduction, focusing on poverty alleviation and infrastructure upgrades. While

there are a number of co-benefits for climate resilience in slum rehabilitation and relocation, increased security of water supply, water recycling, storm water drainage, and sewage treatment plants – climate change was not necessarily the primary motivation. Similarly, the city has bundled conservation and pollution abatement efforts under the climate adaptation agenda, as seen in the Mindhola Creek rehabilitation project funded by the National River Conservation Plan. While the bundling of objectives enables cost-efficiency, it may dilute the quality and effectiveness of climate adaptation measures.

Indeed, it appears that climate considerations are integrated to varying degrees in Surat's adaptation efforts. One interviewee put it this way: "Ultimately, climate resilience is quite a wide subject. I personally believe that when you are taking care of the other things, the city's infrastructure for example, climate resilience is a byproduct" (Bhairav Desai, 16 January 2014). This understanding of climate resilience a "byproduct" suggests that Surat's adaptation measures do not consistently incorporate climate change considerations into planning processes, thereby limiting their ability to address actual and expected climate impacts. These considerations may be cursory at times. For instance, one interviewee stated that "climate concerns" are broadly integrated into various vulnerability reduction measures funded by intergovernmental transfers and grants. When asked *how* considerations of increased flood risks and increased precipitation were integrated, he responded, "No, not so deeply – not so seriously" (B.I. Dalal, 16 January 2014). Although Surat's investments in vulnerability reduction may have been motivated by previous climate-induced experiences, they may not be designed to withstand projected *increases* in precipitation and flooding, among other climate risks.

The climate adaptation agenda appears to have been subsumed as part of the city's development strategy. Indeed, it would be impractical to consider adaptation as exclusive from development, especially given that adaptation must be underpinned by development objectives that address the underlying causes of vulnerability. However, there is a risk that simply investing in development as usual may introduce "mal-adaptations" that reduce the city's resilience to climate change. For instance, the extension of water, sewage, and stormwater

networks, as well as the strengthening of embankment and others flood control mechanisms, have allowed the city to extend outwards along the river and tidal creeks, leading to the precarious development of low-lying floodplains. The focus on traditional development trajectories may diminish the long-term efficacy of climate adaptation measures. In addition, this focus suggests that the climate adaptation agenda has not been accompanied by a necessary shift in values and goals guiding city priorities.

The handful of climate adaptation measures focused on addressing specific climate impacts were funded by Rockefeller Foundation. Unlike the vulnerability reduction measures funded by state and national governments, these climate-focused projects may be considered additional to development. The end-to-end early warning system, the Urban Health Climate Resilience Center, and cool roofing and passive ventilation, for instance, have a particular emphasis on understanding hydro-meteorological impacts, planning for extreme events and uncertainty, and incorporating technological innovations into city operations. However, these types of projects may be difficult for cities in India to pursue using their own resources, given the immediacy of competing and relatively more immediate needs.

5.4 Urban Finance System as a Constraint

The partial implementation of the fiscal and governance reforms outlined in the 74th Constitutional Amendment and JNNURM has resulted in limited autonomy of urban local bodies in India. State governments remain reluctant to devolve control, making financial sustainability a continuing challenge for effective urban governance in Surat and across Indian cities. User charges and property taxes have either yielded inadequate resources, or have not been implemented efficiently. In general, local revenues do not reflect the growth of cities or their economies. The result, as evidenced in Surat, is a high degree of dependence on intergovernmental transfers from state and national governments. While this system of urban public finance has allowed Surat to gradually make investments in climate resilience, it may also constrain its capacity to effectively address climate vulnerabilities in the long run.

First, dependence on external sources of funding makes it difficult for cities to set and maintain priorities for climate adaptation. Given that vulnerabilities are regional or local by nature, effective adaptation strategies must be rooted by local priorities. Grants and fiscal transfers from state and national governments may introduce sectoral or top-down priorities that may or may not align with local priorities. Moreover, the amount of available funds can be somewhat unpredictable or unstable, seeing as they are affected by shifting political dynamics at higher levels of government. The ambiguity surrounding the future of JNNURM, for instance, is a function of the uncertain outcome of the current national elections. The introduction and nature of a second phase will likely depend on which political party comes to power. As such, external funding may not necessarily provide a steady source of support or policy direction for climate adaptation. City leaders need some degree of fiscal autonomy to identify short- and long-term strategies according to stable priorities.

Second, the urban finance system limits access to other sources of finance that could support and sustain climate adaptation. While the Government of India has introduced a number of measures to facilitate private finance for urban infrastructure – including tax exemptions on municipal bonds, pooled finance development, viability gap funding, and credit assessments – there has been limited uptake. After a few municipal bond issues during the first half of this decade, activity almost ceased with the last major issue in 2005, which incidentally coincided with the start of the JNNURM. Similarly, there have been few success stories for public-private partnerships in mobilizing resources for urban infrastructure. One explanation is that easy access to JNNURM funds has eclipsed borrowing by urban local bodies. Another explanation is the lack of capacity at the municipal level to develop and implement public-private partnerships (Mehta and Mehta, 2010). Successfully implementing such market-based mechanisms for infrastructure finance, and related climate adaptation measures, would require strengthening of local revenue collection and administrative capacity, as well as improving transparency and accountability in governance structures.

Third, the urban finance system has entrenched a project-based approach that may impede “transformational” adaptations. According to the literature, implementing transformational adaptation requires resources to initiate and to sustain the effort over time (Pelling, 2010; Kates et al., 2012). However, fiscal transfers and grants dominate Surat’s portfolio of funding sources for climate adaptation measures. Support from these sources is tied to specific projects, and therefore generally limited in scope and duration. This tends to produce incremental adaptations that simply extend current actions and existing behaviors in efforts to deal with new climate vulnerabilities. The project-based approach, though somewhat typical of city planning in India, may come at the expense of a longer-range vision for adapting to climate change. Furthermore, the focus on reducing vulnerability in the near-term has produced a mosaic of sectoral projects that may be difficult to integrate within broader urban policy and comprehensive planning.

One reason⁷ is that the City Development Plans⁷ prepared under JNNURM are not always linked with the detailed project reports that municipal corporations must submit in order to access JNNURM funding, creating a gap between planning and implementation (TERI, 2011). As a result, public capital investments, particularly those lacking the necessary funds for ongoing operations and maintenance, can fall into disrepair, thus creating new vulnerabilities and reducing overall resilience (Eric Chu, Personal communication, 2 April 2014).

Fourth and related, the project-based approach appears to have produced a conception of climate adaptation as an outcome. Despite the delineation of short-, medium- and long-term climate resilience strategies, there appears to be a focus on only fixing known problems in Surat. The City Engineer, a key actor in the city’s climate adaptation planning efforts, remarked, “The main threat of climate change is due to flooding. And that we have almost eliminated! By shifting slums and constructing embankments, 70 percent of the climate risks to the citizens are over” (Jatin Shah, 23 January 2014). This narrow understanding of adaptation discounts the

⁷ Urban local bodies that seek assistance from JNNURM are required to prepare a City Development Plan that includes a strategy to implement reforms and city-level improvements, as well as an investment plan to address the infrastructure needs in a sustainable manner.

dynamic nature of climate risks that shape and in turn are shaped by urbanization. Moreover, it is at odds with the literature, which represents adaptation as an ongoing process characterized by social learning and development rather than as a static end-point (Funfgeld and McEvoy, 2011). In effect, it risks underestimating the intensity and scale of adaptation needs, and may compromise the experimentation and innovation necessary to achieve transformational adaptations. As Surat continues to draw upon a variety of funding sources to support climate adaptation measures, it will have to find ways to balance the project-based availability of funds with a longer-term and more comprehensive vision in order to make efficient, effective and equitable investments in adaptation processes and outcomes.

6: CONCLUSIONS

The Surat case study suggests that despite operating in a context of limited fiscal autonomy, cities in India can marshal funding from state and non-state sources to support climate adaptation. International organizations and philanthropic foundations, in particular, have been critical source of finance for climate adaptation planning in Surat and other cities. Intergovernmental transfers and grant aid can also play a key role in the implementation of climate adaptation strategies. Though these sources are typically linked to policy objectives related to urban development or disaster risk reduction, they afford cities varying degrees of flexibility in usage. Surat has creatively used these funds to implement climate adaptation measures that address local needs and vulnerabilities. Its experience suggests the potential for other cities to draw upon public finance for implementing climate adaptation strategies.

Nonetheless, there are several caveats. In bundling funds with related but distinct policy objectives, cities may limit the effectiveness of their investments in producing positive adaptation outcomes. As Chapter 2 outlines, the climate adaptation, development, and disaster risk reduction policy agendas have fundamental differences that are as important as their synergies. These distinctions must be explicitly acknowledged and carefully weighed in order to identify the appropriate planning and policy tools for addressing specific risks and vulnerabilities. In large part, however, a sectoral approach to planning prevails in India, and the convergences and divergences between these policy agendas have not been adequately explored at the national, state or local levels of government.

The broader urban finance system in India, furthermore, threatens to constrain climate action at the city level. An overwhelming dependence on intergovernmental transfers and grant aid limits the ability of cities to set and maintain priorities, which in turn, narrows the scope for implementing effective and stable climate adaptation measures. Limited fiscal autonomy also appears to have hindered access to alternative sources to finance, for instance municipal bonds

and public-private partnerships. Finally, it has resulted in a project-based approach that may compromise a longer-range and more comprehensive vision for adapting to climate change.

6.1 Lessons from Surat

Financing climate adaptation will be a key issue in cities across India, particularly in light of the constraints posed by the urban finance system. Surat's experience offers some insights about how the availability and type of funding might affect the implementation of climate adaptation on the ground. These insights could be particularly relevant for other rapidly growing second tier cities in India facing a high degree of risk from climate change.

First, local adaptation strategies will be influenced by policy objectives at the state and national levels of government, as well as those introduced by international actors. Urban local bodies in India rely on financial support from higher levels of government to meet their basic mandates. This dependence has exerted a top-down influence on local planning and development processes. Although cities in India are unable to access dedicated sources of climate finance at the global level, this does not preclude climate action. Cities can integrate climate considerations into existing local plans and programs supported by intergovernmental transfers and grants. They can also benefit from transnational partnerships and international organizations that are increasingly active in adaptation planning and implementation in India. But in marshaling various sources of funding, cities will have to carefully navigate multiple policy agendas operating at various scales.

Second, cities can exert control over adaptation implementation through fiscal experimentation at the local level. The inclusion of a budget line dedicated to climate change in the Surat Municipal Corporation's annual budget is a prime example of such experimentation. Despite the nominal budget allocation, the line item signals political commitment to and support for the climate adaptation agenda, which may help to attract climate funds from non-state sources in the future. It also enables greater flexibility than intergovernmental transfers and grants in how these funds might be utilized. Likewise, the legal establishment of the Surat Climate Change Trust was designed to give the city autonomy in financing and implementing

climate adaptation. These innovations, though still relatively new, can help to ensure that adaptation measures are locally relevant and sustained over time. Cities may also consider innovations in financing urban infrastructure as a means to support climate adaptation, for instance, through the municipal bond market and public-private partnerships.

Third, cities in India will likely take an incremental approach to climate adaptation. The status of dedicated climate funds remains highly uncertain, and efforts to engage private sector finance have been fledgling. Local revenues are insufficient for purposes beyond regular operations and maintenance. Intergovernmental transfers and grants are linked to other policy agendas, limiting the availability of funds specifically for climate adaptation purposes. City officials must therefore find ways to integrate adaptation objectives into existing projects and programs, maximizing complementarities and making use of public funds whenever available. This project-based approach, though common in city planning in India, may circumscribe the scope and effectiveness of adaptation actions. It will be crucial to balance short-term project funding with longer-term climate adaptation goals through programmatic planning.

Fourth, local adaptation efforts may not effectively address the new risks and vulnerabilities created by climate change. Given decades of institutional under-investment in urban infrastructure and basic services, state and national government funding schemes are highly focused on urban development and disaster risk reduction. Measures to reduce social and disaster vulnerability certainly contribute to urban resilience, but may not be adequate to address climate risks in the long run. As such, integrating the emergent climate adaptation agenda in these existing policy agendas may require trade-offs in terms of efficacy. Incorporating climate considerations in strategic planning documents, as well as making trade-offs explicit, may be one way forward.

And fifth, implementing climate adaptation requires not only marshaling adequate sources of finance, but also strengthening local governance. Because the responsibility for implementation tends to be local, institutional capacity is crucial to managing multiple funding

sources and policy objectives in order to produce desired adaptation outcomes. This will be particularly important with anticipated increases in international funding streams for climate adaptation in India. Reforming existing institutions or creating new institutions at the city level may be required. Notwithstanding start-up challenges in management, the establishment of the multi-stakeholder Surat Climate Change Trust is an excellent example of how changes in urban governance can support and coordinate climate adaptation efforts.

6.2 Moving Forward

Surat has made remarkable progress in grappling with the challenge of climate change over the past six years. At the present moment, it is amidst major fiscal and political changes. Rockefeller Foundation support to Surat is set to come to an official close this year, requiring the city to seek supplementary funding sources to maintain the ACCCRN pilot projects. This comes on the heels of the conclusion of JNNURM's first phase in 2013. To date, there has been no indication of whether and when a second phase may be launched. The recent landslide victory of the opposition party in national elections will undoubtedly shape the contours of India's urban renewal agenda, which will have critical implications for how structural climate adaptation measures financed in cities. Although the new prime minister of India, Narendra Modi – the former chief minister of Gujarat – has publicly professed his interest in and commitment to climate change, he has neglected to follow this rhetoric with action. It is therefore unclear whether his promises of building a low-carbon national economy will be kept. In light of the current state of ambiguity and flux in India, the ability of the City of Surat to maintain and expand its climate adaptation efforts is imperative. The following recommendations may provide useful approaches to this end.

Build coalitions of support to sustain and move climate adaptation efforts forward in the city.

The Surat Municipal Corporation City Engineer and the President of the Chamber of Commerce and Industry have played an important leadership role in initiating adaptation efforts in Surat. For the most part, however, these efforts are unanchored by a broad base of support. As such, these leaders must more actively engage other public officials, as well as a range of private

sector and civil society actors in the city. The mobilization of widespread support can help to assemble much-needed financial and technical resources for climate adaptation planning and implementation. In a similar vein, building stronger ties to local academic institutions and research communities will be essential to sustaining climate adaptation efforts. Such linkages can help to inform effective policy changes and interventions that meet the needs of local communities. Academic institutions can also play a critical role in generating awareness across all sectors of society, possibly starting with the public school curriculum.

Increase the earmarked budget for climate change to ensure effective investments in local adaptation. Dedicating local resources to climate adaptation should not be merely a symbolic gesture, but also a practical one. By increasing and strengthening its budget allocation for climate change, the Surat Municipal Corporation can maintain control in setting local adaptation priorities and sustaining adaptation measures over time. One way to augment the municipal budget line might be by introducing a local tax on vehicular carbon emissions. This potential revenue stream might be politically justified as compensation for the loss of the Octroi tax. As an added benefit, it would promote behavior changes among individuals and businesses, and perhaps even encourage use of the newly launched Bus Rapid Transit System in Surat. Moreover, the current allocation falls under the broad budget category of “climate change,” which perhaps allows too much room for interpretation. The Surat Municipal Corporation must clearly specify purposes for this line item in order to ensure that funds are effectively used for climate adaptation and/or mitigation efforts.

Develop capacity to mainstream climate change considerations into local level planning and budgeting. Among interviewees in the Surat Municipal Corporation, climate adaptation is widely perceived as a technical and highly specialized field that falls under the jurisdiction of the City Engineer. However, transformative adaptation requires that climate considerations are incorporated into all design, planning and decision-making processes. To move toward this goal, the Surat Municipal Corporation’s human and institutional capacity for climate adaptation must be greatly increased. Raising the level of awareness and education of public officials across

municipal departments is a crucial starting point. There is a particular need to sensitize municipal officials to possible climate change issues and impacts, as well as the importance of adaptation interventions in Surat. Training programs and workshops could provide useful instruction on the technical aspects of climate adaptation planning, thus making the climate change challenge seem more actionable at the local level. This capacity building effort would encourage public officials to proactively incorporate climate considerations and adaptation strategies into departmental planning processes. Related, the Surat Climate Resilience Strategy should be integrated into the City Development Plan to ensure the cohesiveness of an overarching strategy document for the municipal corporation. Importantly, this would also enable budgeting for local adaptation interventions, building implementation strategies, setting timelines, and making the necessary institutional arrangements. In short, the combination of capacity building and mainstreaming would provide a legitimate space for adaptation in the development planning and budgeting process.

Integrate non-structural approaches in climate adaptation strategy to create more financially viable options. To date, Surat's climate adaptation efforts have focused overwhelmingly on engineered solutions to climate adaptation. In part, this is because national and state funding schemes emphasize urban infrastructure and services, as opposed to awareness initiatives or policy incentives. However, such structural adaptation approaches are resource-intensive and can create financial burdens for cities. To create a fuller range of financially viable options, Surat should identify non-structural, low-cost adaptation approaches in its Climate Resilience Strategy. In addition to the awareness raising and capacity building measures described above, such approaches may include improving design standards and working toward integrated resource management. To this end, Surat could promote the use of green and blue infrastructure, which conserves or reconstructs biophysical features of the landscape to maintain ecosystem and human well being. This ecological design approach provides multiple functions and services such as stormwater drainage, water and air purification, recreation spaces, and natural habitat. It can also help to manage high temperatures, water supply, and soil erosion, while delivering several social and economic benefits. These interventions usually

cost less to install and maintain than hard “grey” infrastructure. As such, green and blue infrastructure is increasingly being recognized as a potent climate adaptation strategy (Gill et al., 2007). Surat has an important opportunity to integrate these ecological design principles in the rehabilitation of the Mindhola Creek and the Tapi riverfront. While other waterfront redevelopment projects throughout the state and the country have focused largely on creating social and cultural spaces, Surat could take a more innovative approach that integrates environmental objectives.

Encourage increased use of public-private partnerships to fund infrastructure-related climate adaptations. Surat has deployed this financing model for recreational spaces, city bus services, and solid waste collection. The Rajiv Awas Yojana has recently introduced the public-private partnership model as a potential tool for developing low-income housing in cities. Given these successes, the city should consider expanding the use of these partnerships to climate-proof urban infrastructure, for instance in water supply, sewerage, and energy. To encourage private sector involvement, Surat should establish a dedicated cell to manage a database of public-private partnerships. In addition to working across municipal departments to identify key adaptation projects and prepare detailed projects reports, this cell would be responsible for compiling best practices, developing concession agreements, and providing model documents to facilitate implementation. It could also be responsible for disseminating information to the public in order to ensure transparency. While the Government of Gujarat has already defined policy, legal, and regulatory frameworks to govern public-private partnerships across the state, Surat could go further by delineating critical oversight and dispute resolution procedures.

Explore potential to develop municipal bonds for climate adaptation. Bonds would allow municipal corporations to raise the necessary capital for making long-term investments in climate-resilient infrastructure. Surat should build on the initial successes of the Ahmedabad Municipal Corporation in issuing bonds for water supply and sewerage projects. As one of a handful of cities in India with an AA credit rating, it has an opportunity to take the lead in experimenting with a new class of “climate” bonds. To begin with, Surat can develop a capital

investment plans to determine the viability of climate adaptation projects on the basis of the municipal corporation's overall financial position. Next, structuring bonds will require a high level of specificity about proposed projects and the climate vulnerabilities they seek to address. To this end, Surat can develop model disclosure guidelines and a trust indenture that improve upon those used in Ahmedabad. This would help to ensure the security of bond transactions and increase investor confidence. A key challenge will be in constructing opportunities that allow investors to meet their obligations and that deliver secure, long-term returns at competitive levels of risks. One way to address this challenge might be by aggregating projects and initiatives into larger scale and therefore more attractive investment opportunities (Vaidya and Johnson, 2001).

These recommendations would allow Surat to carve out greater autonomy in implementing and sustaining climate adaptation measures, as well as work toward further institutionalizing climate adaptation processes. Ultimately, however, transformative adaptation will require committed leadership at all levels of government as well as the coordination of policies, incentives and resources across scales and sectors. A key reason is that climate risks are inherently linked to natural systems and extend far beyond administrative boundaries. Cities must therefore work with the relevant departments at the district, state and national levels of government to develop geographically coherent adaptation strategies – for instance, at the river basin or the ecosystem levels. At present, however, urban climate adaptation efforts in Surat are not backed by any policy at the national or state level. Rockefeller Foundation support ensured the city's initial buy-in, but sustaining efforts henceforth demands a strong policy framework. A mandate from state governments – either linked with State Action Plans on Climate Change or other state environment or urban development policies – would be instrumental in ensuring climate action in Surat and other urban areas. Likewise, the articulation of a clear climate adaptation policy from the national government – one that improves upon the ambiguous National Action Plan on Climate Change – would effectively enable climate action at the state and city levels. It is important, however, that each of these

policies or mandates are explicitly defined and propose a detailed plan of implementation, financing and institutional responsibilities.

6.3 Future Research

This research has several important extensions. For instance, the sample of interviewees in Surat was comprised exclusively of municipal officials and members of the Surat Climate Change Trust. While this choice was strategic given the specialized nature of the subject, the limited sample may have introduced biases in developing a narrative around Surat's climate adaptation efforts. The research would greatly benefit from incorporating the views of various civic groups engaged in or affected by climate adaptation efforts. This might include non-governmental organizations, citizen activists, or labor unions – groups that could provide alternative perspectives on the city's efforts to address climate risks. Second, municipal budgetary data in India is notoriously imprecise in India. It is difficult to make claims with any high level of validity based on budget data, because documentation is frequently ambiguous or incomplete. Asking interviewees for clarification was sometimes useful, though it often introduced new sources of uncertainty. Future research might benefit from working closely with the financial departments of municipal corporations to gain clarity on specific budget lines as well as changes in budget reporting across fiscal years. Finally, I chose to conduct the interviews mainly in English, given that I lack technical proficiency in Gujarati to discuss urban development and climate adaptation planning. For interviewees less comfortable with English, this choice may have influenced the quality and depth of their responses. For future research, a translator would help to put interviewees at greater ease and elicit more in-depth responses.

On a more conceptual level, Indian cities are distinct and difficult to compare. The appropriate financing strategy for climate adaptation will vary depending upon a variety of factors such as city size, economic base, civic engagement, political structures, geography, and specific vulnerabilities. While the Surat case study can suggest possible ways forward for climate adaptation planning and implementation in similar cities, it might be exceptional in some regards. Surat, one of the most prosperous cities in India, has a history of collaborating with

private and civil society actors in decision-making processes to maintain economic productivity and to enhance the quality of life. It has also demonstrated a heightened sensitivity to urban governance and environmental issues since the plague outbreak, transforming Surat from one of the dirtiest cities to one of the cleanest (Dutt et al., 2006). As described in previous chapter multidimensional changes – including administrative reorganization, improved distribution of resources, public sector involvement, and stricter monitoring and enforcement – led to dramatic improvements. These experiences undoubtedly contributed to Surat’s ability to strategically build upon donor-initiated planning processes and invest in climate adaptation.

Further research is needed to understand how other cities in India have balanced limited fiscal autonomy with the need for climate adaptation in order to draw stronger comparative lessons. There is a particular need to understand how other cities have sustained their investments in structural and non-structural adaptations over time. Specific approaches might include the development of performance benchmarking tools to measure progress toward climate adaptation objectives. A recent initiative, the International Benchmarking Network for Water and Sanitation Utilities (IBNET), aims to encourage water and sanitation utilities to compile and share a core set of financial, technical, and process indicators in order to improve the quality of services and better meet stakeholder needs (IBNET, 2013). The toolkit provides a useful foundation for developing benchmarking tools specifically for urban climate adaptation efforts. These tools might assess the effectiveness of urban policies and programs in achieving adaptation objectives; efficiency of implementation process; financial performance of urban local bodies; integration of adaptation strategies with legal and regulatory frameworks; collaboration between public and private actors; participation of stakeholders in design and planning processes; consideration of equity issues; transparency of planning and decision-making procedures; and sustainability of climate adaptations over time. The objective of benchmarking is to support access to information in order to promote best practices in financing urban climate adaptation. It can also help cities to understand where they stand on climate adaptation in comparison to other cities, and identify areas for improvement. Comparing experiences in financing climate adaptation will be critical in facilitating learning and replicating successes across cities in India.

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APPENDICES

Appendix A: List of Interviewees

Name	Title	Affiliation
Debasish Basak	Town Planner	Surat Municipal Corporation
B.I. Dalal	Additional City Engineer	Surat Municipal Corporation
Bhairav Desai	Deputy Drainage Engineer	Surat Municipal Corporation
Dr. Vikas Desai	Technical Director	Urban Health Climate Resilience Center
C.Y. Bhatt	Deputy Commissioner of Disaster Management	Surat Municipal Corporation
Jivan Patel	Deputy Commissioner of Planning & Development	Surat Municipal Corporation
K.S.Patel	Additional City Engineer	Surat Municipal Corporation
Mehul Patel	Consultant Taru Leading Edge	Surat Municipal Corporation
Jatin Shah	City Engineer	Surat Municipal Corporation
Ashwin Taylor	JNNURM Cell	Surat Municipal Corporation
Jagdish Thadani	Hydraulic Assistant Engineer	Surat Municipal Corporation
Kamlesh Yagnik	President	South Gujarat Chamber of Commerce & Industry

Appendix B: List of Documents

Municipal	<ul style="list-style-type: none">• Surat Revised City Development Plan 2010-2011• Surat Municipal Corporation Annual Report 2011-2012• Surat Climate Resilience Strategy 2011
State	<ul style="list-style-type: none">• Gujarat Climate Change Action and Adaptation (presentation)• Swarnim Jayanti Mukhya Mantri Saheri Vikas Yojana, Resolution• Gujarat State Disaster Management Authority Constitution
National	<ul style="list-style-type: none">• National River Conservation Plan and the National Ganga River Basin Authority: Guidelines 2010• Rajiv Awas Yojana Scheme Guidelines 2013-2022• Jawaharlal Nehru National Urban Renewal Mission: Impact of Reform Implementation 2010-2011
International	<ul style="list-style-type: none">• Country Programme Action Plan between the Government of India and the United National Development Programme: 2013-2017

Appendix C: List of JNNURM Reforms

<p>State Level Reforms</p>	<ul style="list-style-type: none"> • Full implementation of the 74th Constitutional Amendment Act • Integration of city planning functions with water supply functions • Reform in rent control • Stamp duty rationalization to 5% • Repeal of the Urban Land Ceiling and Regulation Act • Enactment of Community Participation Law • Enactment of Public Disclosure Law
<p>Urban Local Body Reforms</p>	<ul style="list-style-type: none"> • e-Governance set-up • Shift to accrual-based double-entry accounting • Property tax • Levy of reasonable user charges • Internal earmarking of funds for services to urban poor • Provision of basic services for urban poor
<p>Optional Reforms</p>	<ul style="list-style-type: none"> • Introduction of property title certification system • Revision of building by-laws: mandatory rainwater harvesting in all buildings • Earmarking 25% of developed land in all housing projects for economically weaker sections and low-income groups • Simplification of legal and procedural frameworks for conversion of agricultural land • Introduction of computerized process of registration of land and property • By-laws on reuse of recycled water • Administrative reforms • Structural reforms • Encouraging public private partnerships

(Source: MoUD, 2011)