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Cities and climate change

The challenges for governance

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9.1 Introduction

Formulating and implementing effective climate action in cities poses a core set of challenges for city governance. This chapter addresses the need for an empowered governance of cities worldwide, if cities and nations are to successfully confront the challenges of climate change. City governments are constrained on a number of fronts when it comes to formulating and implementing climate action. Many city governments are weakened due to only limited power over and responsibility for key public services, including planning, housing, roads and transportation systems, water, land use, drainage, waste management, and building standards resources (McCarney, 2009). In many of the poorest cities of Asia, Africa, and Latin America, informal areas of the city do not have basic services such as waste collection, piped water, storm and surface drains, and sanitation systems. While all cities and their inhabitants are at risk, the poorest cities and the most vulnerable populations are most likely to bear the greatest burden of the storms, flooding, heat waves, and other impacts anticipated to emerge from global climate change. City governments often lack powers (with respect to higher orders of government – state and national) to raise the revenues required to finance infrastructure investments and address the climate change agenda. When governance capacity is weak and constrained, cities are limited in their abilities to take programmatic action on climate change mitigation and adaptation.

9.2 Cities and climate change: six core governance challenges

New governance challenges for cities are arising as a result of new risks and vulnerabilities associated with climate change. Six core governance challenges are identified here. The body of literature on local climate governance has been growing in recent years, and a brief review of this literature is presented in Box 9.1. While each city faces unique challenges in addressing climate risks, and must find solutions that are adapted to its own context, cities globally depend on effective and long-term solutions that are based on an empowered city governance approach and acknowledge the respective contributions of a broad group of actors that cross jurisdictional and administrative boundaries (McCarney, 2006). The challenge to overcome fragmentation in urban governance is central to moving forward on the climate change agenda globally. Urban areas (and metropolitan areas, made up of more than one urban area) are defined by each country; there is no consistent definition for “urban” or what is a “municipality” throughout the world. Urban data suffer from limitations in terms of reliability and comparability due to definitional issues related to jurisdictional boundaries (McCarney, 2010). The many aspects of risk and vulnerability in cities require more integrated approaches that combine established policies related to urban governance, and management while adding new policy leverage, powers, and responsibilities to the local level of government.

9.2.1 Empowered local governance: political and fiscal

The planning and management functions in cities are more effective when local government is recognized as a legitimate partner in the governance structure of a country, and when financial powers to raise revenues and responsibilities to deliver services are commensurate with urban growth and expansion (McCarney, 2006). Cities are discussing this urban agenda with provincial and national governments around the world. As global entities dedicated to the climate change agenda increasingly point to the significant role of cities in both contributing to and mitigating climate change, the voice of cities in formulating the agenda and their role in taking action locally is also gaining momentum. As a result, the significance of well-governed, well-managed and well-financed city governments to address climate change becomes pivotal in global terms.

When cities are empowered and recognized as significant sites of governance in national and global contexts, they will gain the power to pass legislation related to greenhouse gas emissions; to encourage citizen participation, and to engage with related governmental agencies and local corporate organizations on climate change mitigation and adaptation. These conditions can set in motion a series of activities, including the ability to (McCarney, 2006):

- Build more inclusive institutions in cities for achieving environmental objectives
- To plan and implement transportation systems that support access by all citizens and rational choices on where to live and work that are in keeping with a climate change agenda for the city;
- Ensure strong and robust local economic development patterns that build sustainable economic opportunity for all citizens;
- Address land tenure and land rights in the city and thereby adopt a pro-poor set of policies governing access to and use of land in the city under changing climate conditions;
- Amend building codes and zoning bylaws and adopt flexible yet greener standards governing safer construction of housing, buildings, and infrastructure that are more resilient to climate change risks;
- Develop creative financing tools for mobilizing investments that help to overcome climate risks derived from a lack of basic infrastructure and environmental amenities for all, especially the poorest urban residents in cities.

Recently, efforts to improve urban governance have focused on the essential first step of devolution of power, authority, and resources from the central and sub-national to the municipal level (McCarney, 2006). Governed by the principle of subsidiarity, decentralization processes aim to ensure that decisions are taken, and services delivered, at the sphere of government closest to the people while remaining consistent with the nature of the decisions and services involved. Empowering cities to govern effectively is key to urban reform in countries throughout both the developed and developing worlds. The urban agenda in Canada is focussed on empowering cities with new sources of revenue and new powers to govern

[MITIGATION/ADAPTATION] Box 9.1 Local climate governance: Barriers and motivators to formulating more targeted policies

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This box provides a systematic literature review of local climate governance (Sippel and Jenssen, 2009). A large part of the literature focuses on mitigation and cities in industrialized countries. The analysis also includes recent material on adaptation and cities in developing or industrializing countries. The review categorizes five barriers to formulating more targeted policies for local climate governance.

- 1. Costs of climate policies** Costs are a crucial factor in explaining the lack of widespread citywide climate protection activities (Harrison and McIntosh Sundstrom, 2007). Some mitigation activities (such as collective energy management) are taken by local authorities because they pay off quickly (Alber and Kern, 2008). Even in the case of these “no-regret” measures, local authorities often decide against activities that have high up-front investment costs and long payback periods (Ürge-Vorsatz *et al.*, 2007). In particular, this applies to cities with meagre financial resources, which are often situated in developing countries (Kern *et al.*, 2005; Rezessy *et al.*, 2006; Bai, 2007). However, many cities have not implemented measures that do not require much funding, either (Dhakal and Betsill, 2007). Concerning adaptation measures, costs are important too. However, since adaptation is a more urgent issue as many cities already face climate change impacts, adaptation activities benefit the city directly. Therefore, the willingness to finance adaptation activities is probably higher than the willingness to finance mitigation. Cities in developing countries that are most vulnerable to the impacts of climate change must often start adaptation policy from a situation of “infrastructure backlog” (Bulkeley *et al.*, 2009).
- 2. Lack of cooperation** Climate policymaking requires cooperation on different levels. First, effective implementation of both adaptation and mitigation policies needs cooperation between local stakeholders, such as authorities, businesses, and citizens (Jones *et al.*, 2000). Second, formal city boundaries are often too small to adequately address issues such as transport (mitigation) or water management (adaptation). Nevertheless, regional cooperation on climate policies that reaches beyond city boundaries is scarce (Wilbanks and Kates, 1999). Third, cooperation between cities on the one hand and the international and national levels of climate governance on the other hand is crucial. Because of the “Tragedy of the Commons,” such cooperation seems especially important for mitigation policies (Lutsey and Sperling, 2008). Policy at global and national levels may inspire local policies, enable local authorities, fund local activities, or govern local policies by authority. National policies that do not address the city level specifically, such as a national carbon tax, feed-in tariffs or energy market regulation, also significantly influence local climate poli-

cies (Fleming and Webber, 2004; Bulkeley and Kern, 2006; Schreurs, 2008; Schröder and Bulkeley, 2009).

- 3. Lack of leadership and political support** Frequently, political and administrative leadership is cited as a precondition for successful local climate policymaking. Motivation and commitment of decision-makers and administrative staff members can make a difference, e.g., by putting climate protection on the agenda and convincing council members, by linking climate policies with other local issues that generate co-benefits and securing project-funding, and by overcoming fragmentation and building consensus (Betsill, 2001; Carmin *et al.*, 2009; McCarney, 2009). Especially in the initial phase and when taking controversial decisions, political support is absolutely essential for successful climate governance. However, political support and leadership may not be sufficient where financial constraints are too high (both costs of climate policies and lack of financial and human resources) (Kern *et al.*, 2005).
- 4. Limited monitoring and evaluation of policies** The evaluation of mitigation policies requires emission inventories. Yet there is as yet no generally agreed methodology at the city level (Kern *et al.*, 2005). Methodologies differ, depending on whether they are production or consumption based and on which sectors they include (Dodman, 2009). In addition, access to emission data is often difficult, and even more so in cities of developing and industrializing countries (Bulkeley *et al.*, 2009; Dhakal, 2004, 2009). The combination of these two factors makes emission inventories time-consuming and costly, and the evaluation of mitigation policies difficult.
- 5. Tragedy of the Commons** While local adaptation activities benefit a city directly, the benefits of local mitigation activities are non-excludable. Because the greenhouse effect of emissions occurs globally and independently of their place of origin, local mitigation measures lead to very small benefits for everyone. Therefore local climate protection underlies the logic of the “Tragedy of the Commons” (Kousky and Schneider, 2003). Some urban stakeholders argue that their cities cannot tackle climate change effectively on their own but only in a joint effort with all other local governments. Following economic rationality, implementing measures and spending local resources is not sensible if others do not take measures as well. In the absence of an adequate global climate governance framework, this results in a lack of mitigation measures (Droege, 2002; Fleming and Webber, 2004).

With regard to overcoming these barriers, the literature review found that the three key motivations for local mitigation policies are cost savings, improvement of air quality, and reduction of vulnerability (Sippel and Jenssen, 2009). In adaptation, key motivations are reduction in vulnerability, a design for smart growth, internal pressure, and improvement of a city's reputation.

Source: Sippel, M. and Jensen, T. (2009).

effectively. This is a priority goal of city mayors in their interactions with provincial and federal governments. The Federation of Canadian Municipalities and provincial associations have taken up this agenda and established an effective voice for ensuring its success.

Globally, discussions on how to enhance urban governance have identified the need for central and provincial levels of government to be engaged in the cities agenda, and to foster the important role of cities in promoting development and civic engagement (McCarney, 2006). The national government in Brazil, for example, enacted a “City Statute” in 2001 giving municipalities the legal power to better plan urban development, to democratize local decision-making and to encourage more inclusive cities (Fernandes, 2001). The significance of national government interactions with cities, as well as by provinces/states in urban development, has been emphasized in many decentralization strategies. A new federalism is emerging that positions cities as critical partners in governing and fiscal relationship. This is increasingly recognized as a pivotal policy platform for both global actions on climate change and local responsibility for mitigating climate change and building climate resilient cities (McCarney 2006; ICLEI, 2010).

Although progress is being made, city leaders are not usually at the table when international protocols and agreements on climate change are discussed by member states and when states decide on whether to sign and support these international agreements. The vulnerability of cities to climate change risks is largely underestimated in these negotiations. Without established data and standardized city indicators on climate change, it is more challenging for cities to enter into these global discussions. With increasing urban vulnerability being recognized however, estimated simply by the fact of the increasing dominance of city dwellers worldwide and the increasing visibility of climate change vulnerabilities in cities, it has become more pressing for city governments to be considered as new sites of governance in global negotiations on climate change and in decision-making related to risk assessments. In this context, cities are increasingly joining international cooperative networks such as C40, the International Council for Local Environmental Initiatives (ICLEI), Cities for Climate Protection (CCP), and the US Conference of Mayors Climate Protection Agreement. These growing climate networks for cities are detailed in Box 9.2.

[MITIGATION/ADAPTATION] Box 9.2 Why do cities participate in global climate networks?

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Cities and local governments that have no binding obligations to reduce greenhouse gas emissions for international treaties such as the Kyoto Protocol are nevertheless trying to tackle global climate change. In addition, these cities and municipal governments have formed cooperative networks to work together on climate change.

Which factors are associated with cities’ participation in global climate change networks, even when their national governments do not or need not (i.e., non-Annex 1 countries) comply with the Kyoto Protocol? Global cities – hubs of international, economic, and policy interactions – are more likely to commit to international networks for addressing global climate change issues because they are centers of ideas and policy diffusion and because they have economic interests regarding climate change.

Whether a city joins a global climate change network voluntarily is an indication of its willingness and commitment to learn about and collaborate on climate change responses. Given that climate change is not a problem that a single local government can solve by itself, learning and collaborating through networks allows a city government to expand its capacity to handle climate change issues.

The logic of a city’s participation in international environmental governance in climate change networks is related to the role cities increasingly play in the global economic context. First, global cities play a central role as hubs in the diffusion of ideas and the flow of people. A global city with a cosmopolitan identity and status as a center of diffusion provides a strong incentive

for a city to actively participate in global environmental issues. Second, international socialization takes place in a global city with numerous interactions via conferences and contacts. Conferences in global cities institutionalize socialization among policymakers, scientists, and interest groups. Third, a global city is financially motivated to cope with climate change issues.

Aside from the degree of cities’ integration with globalization, vulnerability to climate change also plays a role. Given the unintended consequences and risks of climate change, it is critical to answer the question of “conflict of accountability” over why and how particular definitions of risk and responsibility are controlled and legitimated. It is important to note that the risks of climate change are unevenly distributed across geography, social classes, and demography.

In addition to cities’ own attributes, the characteristics of nation states in which cities are located influence city level policies, as cities are under the hierarchy of a nation state. Attributes of the country may affect the behavior of cities’ international activities. In particular, regime types are thought to be the primary factor influencing countries’ participation in international treaties and better environmental outcomes.

Global cities create networks of interdependence that span international boundaries and thus encourage collective action on climate change. Global cities are more likely to commit themselves to the global environmental networks like the C40 (Cities Climate Leadership Group) and CCP (Cities for Climate Protection). The position of the city in the global economy and international transport system is crucial to socialization and the diffusion of ideas on global environmental responsibility.

Source: Lee (2010).

National governments increasingly are confronting new and emerging global agendas on climate change. Because many of these agendas find expression in cities, global commitments negotiated by national governments must be rooted in dialogue at the city level to ensure that local authorities are part of the decision-making and, as importantly, integral parts of mitigation, adaptation, and implementation processes. Stronger intergovernmental relations, local representation processes, sub-national institutions, and financing mechanisms to support sub-national government forms are critical needs for policymakers and leaders in all levels of government, as well as areas of focus for researchers, planners, and international agencies concerned with climate change (McCarney, 2010).

Given the global estimates that energy for heating and lighting residential and commercial building generates nearly a quarter of greenhouse gas emissions globally, and that transport contributes 13.5 percent (of which 10 percent is attributed to road transport) (United Nations 2008a), we can assume a sizeable portion of this volume of emissions is generated in cities. According to the Clinton Foundation, large cities are responsible for the majority of the greenhouse gases released into our atmosphere. Greenhouse gas emissions are usually under the control or influence of local governments since a majority of these emissions are linked to urban form that affects transportation and energy consumption. For example, according to a recent calculation in Canada by the Province of British Columbia, 43 percent of its provincial greenhouse gas emissions are within the realm of responsibility and authority of local governments (Cavens *et al.*, 2008). The World Bank estimates that the transport sector alone accounts for a third or more of total greenhouse gas emissions in metropolitan areas. Therefore cities have the potential, and indeed are becoming, the key actors in global mitigation efforts. City governments can influence patterns of energy and land use through important interventions under their control, including land use planning, urban design, zoning and local bylaws including building codes and height bylaws, transport planning including transit planning road networks, master plan and subdivision controls.

A few examples of city action in the field of climate change mitigation demonstrate the extent to which governance efforts at the city level can have real influence. For instance, the Vienna (Austria) City Council adopted the city's Climate Protection Programme as a framework for its Eco-Business plan. The results have been reductions in solid waste output by 109,300 tons, toxic solid wastes by 1,325 tons, and carbon dioxide emissions by 42,765 tons. This Eco-Business plan has saved a total of 138.7 million kWh of energy and 1,325,000 cubic meters of drinking water. The Eco-Business plan is also now being implemented in Chennai, India, and Athens, Greece. The City of Calgary, Canada, is achieving significant electricity savings and reducing greenhouse gas emissions with the EnviroSmart Retrofit Project. Most of Calgary's residential streetlights are being changed to more energy efficient flathead lenses. Streetlight wattage is being reduced from 200 W to 100 W on residential local roads and from 250 W to 150 W on collector roads (UN-HABITAT, 2008).

In the building sector, improvements to building codes and certification processes for greener buildings are being adopted by a number of cities as a means of promoting mitigation. The City of Johannesburg, South Africa has implemented measures that include retrofitting of council buildings, energy savings in water pump installations, and methane gas recovery. One set of measures already well established is the LEED certification framework that ensures a building is environmentally responsible by providing independent, third-party verification. LEED certification seeks to ensure that a building project meets the highest green building and performance measures. The average LEED certified building uses \approx 30 percent less energy, 30–50 percent less water and diverts up to 97 percent of its waste from landfill (US Environmental Protection Agency, 2007).

Mexico City has taken various measures to mitigate the effects of climate change by taking action in the areas of water, energy, transportation, and waste to reduce its carbon dioxide emissions. In regards to energy, Mexico City has moved to secure more sustainable housing and buildings through action to reduce energy consumption. These include establishing environmental certification systems for buildings and providing funding for new housing that integrates sustainability criteria. Various energy efficiency programs have been in place to reduce emissions, including efficient lighting in buildings, efficient street lighting, and promoting solar energy in businesses and government buildings. Regarding the water sector, Mexico City has taken action to reduce emissions from septic systems by constructing sewerage and water treatment services in areas of low methane gas. Some of the actions taken in the transportation sector include an obligatory school transportation system, which will reduce CO₂ emissions by 470,958 tons per year by ensuring that students take public transportation to school. Mexico City will also expand its transportation system and the implementation of non-motorized mobility and streetcar corridors as an effort to reduce emissions. In regards to waste management, the government plans on capturing and exploiting the bio-gas emitted from the Bordo Poniente State 4 landfill and eventually installing an electrical power plant, which will reduce emissions by 1,400,000 tons annually (Secretaria del Medio Ambiente del Distrito Federal, 2008). Additional details on the development of Mexico City's climate change mitigation efforts and also the hindrances that have affected policy change are provided in Box 9.3.

In the United States, the lack of action by the national government has resulted in a number of cities taking independent action to promote both mitigation and adaptation. As mentioned in chapter 8, King County (which includes the City of Seattle) in Washington State has shown initiative in developing a county climate plan (King County, 2007; Swope, 2007). Based on projections by the University of Washington's Climate Impacts Group for the Puget Sound, King County has developed a set of guidelines for incorporating mitigation and adaptation goals into county and city agencies. They also identified urgent adaptation needs such as those related to specific water supply pipelines or county roads within or close to floodplains. The County also is taking steps to improve its capacity to undertake adaptation planning by,

[MITIGATION] Box 9.3 How do local authorities in Mexico City manage climate change?

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Local authorities in Mexico City have developed a refined framing of greenhouse gas emissions and their relationships to air quality. They have designed strategies and institutional structures to target air quality, the main local concern, and to relate it to climate change; hence authorities “localized” one issue of carbon emissions by relating them to an existing local agenda. The existence of effective policy entrepreneurs and multinational networks, such as the group led by Mario Molina, Claudia Scheinbaum (Secretary of Environment of the Federal District during 2000–6), and ICLEI, played a key role in launching and shaping this agenda and in facilitating an ongoing learning process.

Nevertheless, this influence was not enough to push real and effective policy strategies and actions. Unlike the integrated and broader framing of greenhouse gases, the Local Strategy of Climate Action, and Mexico City’s active participation in ICLEI and the C40 (cities climate leadership group), policy actions have remained narrow. Between 1990 and 2007, the energy sector received the biggest share of financing (between 30 and 60 percent) from three atmospheric programs, most of which was allocated to improve the quality of fuels. Standards and technologies to improve energy efficiency, reduce emissions by automobiles (e.g., catalytic converters), monitor emissions, and implement the no-driving day also received between 20 and 70 percent of the total financing.

Policymaking was constrained by diverse institutional factors. The administrative structures of governance did not align with the city’s boundaries and carbon-relevant functioning. The seat of federal powers is in the Federal District, where Mexico City, the most important national economic hub, has been historically located. In its double role, Mexico City faced almost a century of contradictory processes of centralized control by the federation and institutional fragmentation of local structures and political participation. A component of the city’s political reform, starting in the 1980s, focused on democracy and political rights (e.g., the legislative body of the Federal District gained considerable legislative powers), but did not change the uncoordinated and fragmented government structure of Mexico City, currently managed by various governmental entities: the Federal District with its 16 delegations, the State of Mexico with 35 conurbanized municipalities, and the federal government still exerting a strong influence on Mexico City.

Two additional components of the political reform platform, decentralization and deregulation, did not solve the issues of centralization, complexity, and fragmentation. Diverse coordinating commissions and programs have been created to address city level carbon and climate-relevant issues such as urban planning, transportation, and human settlement. The commissions have functioned as a relatively lightweight institutional instrument mobilizing relevant stakeholders to focus on key issues. Yet they did not seem to help authorities create the much-needed coordination thus far. Diverse factors explain the lack of fit, coordination, and other institutional constraints facing the city.

One factor is the disparity between the fiscal capacity of the federal government and the Federal District on the one hand and of the states and municipalities on the other. The federal government gets the lion’s share of tax revenues (74.1 percent), the Federal District and Delegations receive 12.9 percent and 9.1 percent respectively, and such other entities as the State of Mexico and the municipalities get only a tiny percentage (4.5 percent). This leads to a paradox: more responsibilities are delegated – decentralized – to local authorities, but they lack the resources to undertake effective policies.

Second, authorities do not have a culture of cooperation or a common and broadly shared metropolitan vision, which may be due to the effects of both election laws and governing by diverse parties. Governors and the president are elected for a single 6-year term; municipal presidents and “*delegados*” are limited to a single three-year period, which may be a factor preventing long-term accountability in policymaking. The three tiers of government are governed by at least three different parties (National Action or PAN, Institutionalized Revolution or PRI and Democratic Revolution or PRD).

The government has lacked other features of institutional capacity (e.g., human resources, money, and power) to manage air quality and greenhouse gas emissions. Authorities lack sufficient and adequate personnel with the technical knowledge to monitor emissions and see that standards are met. On top of that, environmental efforts are constrained by institutional instability. High turnover rates among government personnel and technical staff have made training efforts less effective.

Mexico City in short has developed important efforts to curb its greenhouse gas emissions. Policy networks, political leaders, and research groups have been critical in launching a climate agenda. Nevertheless, this has not been enough to push effective policies. Policymaking has been constrained by two sets of institutional factors: the problem of fragmentation in local governance and a lack of institutional capacity.

In recent years, policy conditions have started to improve. Mexico City has become an even more effective leader in climate change, with Mayor Marcelo Ebrard, Head of the World Council of Mayors for Climate Change Action, hosting the Mexico City Cities Climate Summit before the 16th Conference of the Parties in Cancun in November, 2010. In 2008, Mexico City was the first city in Latin America to implement a Climate Action Program, which, according to the Government of Mexico City, has enabled the reduction of ~1.4 million metric tons of CO₂-equivalent, ~4% of the city’s emissions (Government of Mexico City, 2010). Components of the program include a zero-emission transport corridor, public bicycle system, replacement of minibuses and taxis with lower-emitting vehicles, sustainable housing, regulations to encourage the use of solar collectors in commercial and services sectors, green roofs, restoration of ecosystems outside the city, and development and use of an environmental management system. Researchers are currently evaluating these actions for their effectiveness.

Sources: Government of Mexico City (2010), Romero-Lankao (2007).

for example, entering into a collaborative agreement with the Climate Impacts Group, educating appropriate county staff in climate change science, and raising public awareness (King County, 2007). Although the plan does not include specific implementation steps, its goal of incorporating climate change adaptation considerations in all relevant county plans and projects, or mainstreaming such efforts, is indicative of proactive climate leadership and management (Blanco and Alberti, 2009).

Evidence about the potential impacts of climate change has been an influential driver of adaptation planning in cities around the world. One example where this is the case is Durban, South Africa. After learning about climate impacts projected for the global south, and conducting a vulnerability assessment, it became clear that the city and its inhabitants were at risk from climate impacts and that initiating adaptation planning was a pressing issue in addition to reducing greenhouse gas emissions. Durban is not alone in making strides in advancing adaptation as other cities globally (New York City and Quito, Ecuador, are noteworthy) are making significant progress in this arena, many without national level support for their work. Cities are progressing in planning and implementation processes at different rates. The main difference in the rate of mainstreaming appears to be the commitment of local government officials, the use of adaptation as a filter for new initiatives, the degree to which adaptation measures are linked to development goals, and the allocation of local resources to advance an adaptation agenda (Carmin *et al.*, 2009). Box 9.4 details the financial and administrative barriers to implementing adaptation strategies that city managers and local governments confront.

9.2.2 Jurisdictional boundaries: towards a metropolitan governance of climate change

In considering cities and their governance capacity to address climate change, an emerging core set of challenges reflects the complexity of city-level politics, the multiple and overlapping agency responsibilities for service sectors, and the spatial challenges associated with municipal jurisdictional boundaries. Conceptualizing vast, and often diffuse, urban territories and their spread across existing municipal boundaries and broader jurisdictions are difficult tasks. This conceptual challenge mirrors a movement in local governance reform that is in a continuous state of flux, experiment, and re-formulation.

World trends in urbanization are causing metropolitan populations to spill beyond their city limits, rendering the traditional municipal boundaries and, by extension, the traditional governing structures and institutions outdated (McCarney and Stren, 2009). As urban areas around the world continue to expand in terms of both density and horizontal space (Angel *et al.*, 2005), there is a need to govern these large areas in a coherent fashion. Highly fragmented governance arrangements in many metropolitan areas make efficient planning, management, and urban financing for area-wide service provision a difficult and ongoing challenge (Klink, 2007; Lefèvre, 2007). Climate change

action, however, requires coherence and integration across these jurisdictions. The formulation and implementation of Paris's climate plan provides a lesson on the challenge of planning within an expanding municipal boundary (Box 9.5).

This metropolitan expansion is not just in terms of population settlement and spatial sprawl but, perhaps more importantly, in terms of their social and economic spheres of influence. The functional area of cities has extended beyond the jurisdictional boundaries. Cities often have extensive labor, real estate, financial, business, and service markets that extend over the jurisdictional territories of several municipalities and, in some cases, over more than one state or provincial boundary. In a number of cases cities have spread across international boundaries. This expansion is taking place regardless of municipal jurisdictional boundaries.

Cities are the staging sites for meeting the serious challenges of climate change. When considering climate action in these large metropolitan areas, whether in terms of measuring risks, establishing indicators, or creating mitigation or adaptation strategies, the challenges of metropolitan governance and the contexts of administrative, management, and political fragmentation are critical to confront. For example, the metropolitan area of Mexico City (18 million people) extends over the territories of municipalities of two states as well as the Federal District to include as many as 58 municipalities; the economy of Buenos Aires covers the territories of the City of Buenos Aires (3 million people) and the 32 municipalities of the Province of Buenos Aires (9 million people) (McCarney and Stren, 2008). Similarly, in Africa, Metropolitan Johannesburg (7.2 million people) encompasses Ekurhuleni (made up of the East Rand), the West Rand District Municipality (the West Rand) and the City of Johannesburg (Cameron, 2005). Abidjan (with a population of 3.5 million) has expanded to encompass 196 local government units, which include municipalities and surrounding rural areas (Stren, 2007). In Asia, the Metropolitan Manila Area in the Philippines is composed of ten cities and seven municipalities, with a total population of approximately 11 million; while Cebu City comprises seven cities and six municipalities (with a population of 1,930,096) (McCarney and Stren, 2008). The Tokyo metropolitan region, with an estimated population of 35 million, contains 365 municipal areas (Sorensen, 2001). In North America, Metropolitan Minneapolis-Saint Paul (with a population of 3,502,891) is composed of 188 cities and townships (Hamilton, 1999). Portland, Oregon, with approximately 1.5 million inhabitants, covers three counties and 24 local governments (McCarney and Stren, 2008). These examples are just a few of many metropolitan areas worldwide that are growing quickly and expanding across territories, creating new pressures on the existing governing arrangements (McCarney and Stren, 2008).

These cases are not the exception. Most of the world's largest cities are made up of more than one urban unit. However, most of our comparative statistics on cities and metropolitan areas are based on data that do not attend to these differentials in units. And because metropolitan areas are rarely legally defined entities, there may be a number of different possible

[ADAPTATION] Box 9.4 Urban climate change adaptation: Competencies and finances from an economic perspective

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Most action in urban climate policy has emphasized mitigation in cities in the global north, such as London. Yet cities are increasingly aware of the challenge of adapting to global climate change. The diffusion of adaptation into cities will rely greatly on mobilizing potentials and overcoming obstacles of a political, financial, and administrative nature. Cities' adaptation spillovers (in contrast to mitigation) are site-specific, and require adequate responsibilities and resources to be addressed.

The city manager can only act on adaptation if enabled by legislative and administrative powers for climate policy measures. In many countries (especially of the global south), some key political powers needed for urban action reside at the central level. While this can be adequate for many climate mitigation issues (e.g., defining national reduction targets, distributing them among sectors, or introducing national policy measures), adaptation issues are in most cases regional or local by nature. This means that risk management (e.g., infrastructure planning, sanitation, resource management, or measures for residents' health) is primarily a task that is under local management. Equipping city managers with the information and authority to deal with adaptation issues is therefore a vital prerequisite. This requires a division of functions between national and city levels, whereby the (vertical) allocation of adaptation functions to the city level should be the rule. National adaptation measures or shared functions between the national and the city level should rather be the exception and restricted to cases where regional externalities are predominant or nationally decided and financed infrastructure is involved (pipelines, inter-urban links).

Furthermore, an effective (horizontal) distribution of functions between the various sub-national entities is required, particularly when megacities are involved. In the case of Mexico City, for example, the distribution of functions between the National Government administration, the Federal District and the administrations of the states of Mexico, Puebla, and Hidalgo, has produced overlapping competencies resulting in weak political responsibilities. Although some coordination units between these entities exist, they are not defined by clear competencies that empower the groups to take responsibility. Adaptation to climate change is harder to achieve in such a setting, because the different interests tend to conflict and do not allow an overall planning process.

To develop adaptation strategies, empowered city managers also need financial resources and competencies for managing them on a long-term basis. There are three options for cities to receive revenues:

- cities' own sources, such as fees, charges, or taxes
- taxes or (general or special-purpose) grants allocated from higher levels of government
- international funds.

One could argue that it is sufficient for senior levels of government to allocate funds to city managers for financing public expenditure and meeting the cities' adaptation requirements. This, however, seems neither feasible nor adequate. First, national governments also suffer from scarcities that limit transfers to their sub-levels. Second, and more important, city managers need some degree of autonomy to decide on adaptation actions – some of them long term – according to stable priorities. The examples of early adaptation highlight that setting and maintaining priorities is a decisive element for adaptation strategies and their long-term investments. Setting priorities is more difficult to define and maintain if the resources come – already labelled – from an external source, i.e., the national government. In contrast, it is easier to choose cities' priorities if the benefits of certain measures are balanced against the respective costs. To achieve this, it is imperative that city managers have responsibility for and decide upon both adaptation measures (and their respective inter-temporal benefits) and financial burdens.

This poses a major challenge to cities in developing countries where own-source revenues are very low in relative terms and some of that revenue is collected by national authorities. The combination of short-lasting administrations, weak local revenue, and long-term implementation of adaptation strategies calls for:

- stronger articulation between national governments and city managers to use national transfers to enhance local fiscal capacities
- city managers to take advantage of the international markets of carbon for adaptation/mitigation infrastructure (such as improved public transportation and solid waste and wastewater management)
- the design of political mechanisms to prioritize and maintain the adaptation effort over time.

In developed countries, cities can probably best achieve their adaptation strategies when they have responsibility to raise revenues from their own sources. Grants from national governments or from abroad should therefore only be given if the city managers' revenues are not sufficient or in the case of external effects. Limiting transfers (grants) to improving revenue situations (general grants) or for regional external effects (special-purpose grants) may be mechanisms to explore.

boundaries for a commonly understood extended urban area; for example, New York City and the New York Metropolitan Region, or the City of Toronto and the Greater Toronto Area (McCarney and Stren, 2008). In all these cases, different designations will mean different political arenas for policy and

planning as well as different area measurements, service areas, and populations. Not only do inconsistent definitions pose challenges for governance, for planning, and for research, but also for performance targets, indicators, and measurements in the field of climate change.

[MITIGATION] Box 9.5 An effective climate plan (CP) for Paris, France: The need to develop a metropolitan perspective

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Formulating and implementing a climate plan (CP) represents one more task to be completed by cities, in addition to producing their major land use plans and transportation planning documents. Climate plan development is a challenge as it requires achieving coherence among three major planning documents. This task is made more difficult when a large portion of a city's population lives in informal neighborhoods that lack basic services. Establishing a coherent and effective CP in rich and poor countries requires the delineation of an effective territory to which the plan can be applied. This is a complex task as cities often take the form of large urbanized areas composed of a number of municipalities or local governments. A CP formulated by a central city in a city-region or a metropolitan area risks a lack of coherence if it does not apply to adjacent municipalities and others that make up the greater urbanized area, as in the case of Paris, France.

The Plan Climat de Paris (PCP), adopted in October 2007, elaborates Paris's goal to reduce greenhouse gas emissions to a quarter of 2007 levels by 2050 (following European and national norms). The PCP is organized around mitigation measures dealing with buildings' energy efficiency, eco-neighborhoods, and transportation. The building section emphasizes housing (14 percent of the Parisian housing stock) as well as the need to apply "new" national norms to all buildings. Paris owns 2.5 million square meters of municipal offices and social centers, which are a focus of the climate plan's energy efficiency goals. The PCP also refers to new eco-neighborhoods including ZAC (Zone d'Aménagement Concerté [urban development zone]) Gare de Rungis, ZAC Boucicaut, ZAC Clichy-

Batignolles and ZAC Pajol. Regarding transportation, most city council members have agreed to the goal of halving the number of cars in Paris and promoting cycling and transit as environmentally friendly alternative transport options. Paris launched Velo Lib (a local initiative that provides convenient public bike rentals) in 2007, closed a freeway for a month of the summer in 2002 to be transformed into a pedestrian walking promenade, and has begun to invest in a new fleet of streetcars.

The PCP's objectives and measures are aligned with Paris's other major planning documents (Plan Local d'Urbanisme and Plan des Déplacements Urbains). However, Paris's climate plan is only applied to the city of Paris, which is the central city within a large urban area. The Plan Climat de Paris raises two issues: it is limited to an area of 105 km² and does not include additional municipalities, which make up a dense urban area of 5 million inhabitants distributed over 700 km² (belonging to three other "départements"); and it does not address airplane greenhouse gas emissions within its transportation strategy. Paris is a global city facing the dilemma of reducing greenhouse gas emissions without compromising the local economy. The city attracts a large number of tourists, hosts a diplomatic community as France's national capital, and includes a cosmopolitan business community. Given Paris's attractiveness in different domains, air transportation has been increasing by between 3 and 5 percent per year in recent years. According to Bilan Carbone (a greenhouse gas emissions assessment tool) (<http://wwwz.ademe.fr>) (Agence de l'Environnement et de la Maitrise de l'Energie), air transportation represents 40 percent of the volume of greenhouse gases produced by the transportation sector. Implementing a CP implies conceptualizing an optimal territorial scale for dealing with climate change within a sustainable perspective that confronts the dual challenges of economic development and social cohesion.

As a result, a significant challenge confronting the larger metropolitan centers in addressing climate change is that associated with fragmentation of local governing institutions. In the United States for example, local home rule has led to a patchwork of local governments often in fiscal competition with each other for highly valued property that yields high tax revenues. In the United States, federal and state governments have exercised very little control over land uses. The power to regulate land use and to provide for local infrastructure comes from the states, but operates primarily at the municipal level. In addition, many urban services, such as water supply, wastewater treatment, waste disposal, fire services, etc., are often supplied by limited government special districts, with their own urban agendas. In 2002, there were over 32,000 special districts, not counting school districts in the United States (Bierhanzl and Downing, 2004). This is in contrast to over 19,000 municipalities. Thus, suburbanization and increasing use of special districts to provide urban services has led to increasing governance fragmentation in metropolitan regions.

Plagued with metropolitan fragmentation, regional transportation congestion, degradation of environmental resources, and

weak land use planning regulatory frameworks, about a dozen states, including Oregon, Florida, and Washington, have established state-wide planning programs that mandate local planning and regional or county coordination. These programs have had varying degrees of effectiveness (Nelson and Moore 1996; Burby and May, 1997; Weitz and Moore, 1998; Carruthers, 2002; Wassmer, 2006; Carlson and Dierwechter, 2007; Yin and Sun, 2007). Portland Metropolitan area is considered the most successful. This is partly due to its state-wide planning program, and to its unique metropolitan governance system (Blanco, 2007). Portland's Metro regional planning agency was established in 1992. It is still the only directly elected regional government in the United States with both service (for example, solid waste, regional parks, Convention Center, etc.) and regional planning responsibilities (DeGrove and Mines, 1992; Seltzer, 2004). It encompasses the Portland Urban Growth Boundary, and serves more than 1.3 million people in Clackamas, Multnomah, and Washington counties, and the 25 cities in the Portland, metropolitan area. Metro is governed by a council president elected by the region as a whole, and six councillors elected by district; an auditor is also elected region-wide. Metro has fiscal powers,

including the ability to levy property tax, sales tax, and income tax with voter approval, and limited taxes without voter approval. The case of the city of Tampere, Finland, reveals how one city, recognizing the limits of its city's jurisdictional boundary to effectively engage in climate change mitigation, launched a climate strategy process with seven neighboring municipalities in 2007. This experience is detailed in Box 9.6 below.

Metropolitan-level structures and cooperative arrangements often break down in the absence of solid legal frameworks and constitutional support for this "tier" of governance (McCarney, 1996). As a result, metropolitan authorities often lack adequate resources for governing. The challenges of equitable development between different groups in these vast urban territories point to the need for major improvements in the provision of public services such as health care, shelter and housing, education, water supply, and sanitation. Urban poverty has also been worsening and, in many cities, it too has been spreading outwards, rendering the areas on the urban periphery of these metropolitan areas some of the poorest and most heavily underserved settlements (McCarney, 2010). Formulating effective mitigation and adaptation strategies on climate change demands more integrated planning, delivery of services, and policies than these multiple but individually bounded cities can provide. Governing in this fragmented context of multiple jurisdictional boundaries has become much more complex since a decision made in one municipality that is part of the city affects the whole urban area (McCarney, 2010).

For cities to effectively address the challenges of climate change, coordination and overcoming the problems of fragmentation in political institutions locally is a core requirement. Urban metropolitan areas demand and consume vast amounts of energy and water and other material resources that impact climate change. Cities are both victims and perpetrators of climate change. They generate significant levels of solid waste, electricity demand, transport-related emissions, and space-heating and cooling demand. Cities and local governments are well positioned to set the enabling framework for climate change mitigation strategies, as well as taking a leadership role in addressing the challenges related to hazard management as countries adapt to climate change. However, institutional fragmentation across metropolitan areas is closely related to the escalating risks associated with climate change in cities. This reality introduces new challenges of governance; in particular, what needs to be better addressed in terms of the challenge of defining new metropolitan governance systems for managing climate change.

9.2.3 Good planning and effective urban management

Emerging climate change risks identified globally create new vulnerabilities for cities. For example, the rise in extreme weather events associated with climate change places major cities, particularly those located in coastal areas, in unstable and vulnerable conditions. Global increases in natural disasters associated with climate change have shown that the nature of disasters in

cities has become more multifaceted and so must the approach to their management. Urban health is particularly threatened under conditions of urban poverty. When basic infrastructure is inadequate, poor sanitation and drainage and impure drinking water aid in the transmission of infectious diseases, which puts poor urban households at high risk. This situation is worsened under circumstances of higher densities in urban areas. Climate change vulnerabilities thus require strategic urban management and planning practices, and higher levels of investments in infrastructure, together with better-prepared local governments.

Planning and management tools can help to address the critical link between emissions and urban form, particularly in terms of transportation and building energy consumption. For example official plans, development guidelines, development permits, densification plans, transit planning and pricing building codes, and a number of other planning tools can help to address greenhouse gas emissions in cities as climate change mitigation strategies. For effective planning, spatial data that link greenhouse gas emissions with urban form and city expansion would be valuable. Such information will strengthen locally relevant policy decisions and build support and understanding by the public (Miller *et al.*, 2008).

Access to land and housing and security of tenure are critical issues in the alleviation of urban poverty worldwide (McCarney, 2010) and also relate to climate change adaptation. In cities with large urban poor populations, security of tenure is generally acknowledged as the first step in the integration of slums and low-income settlements. When tenure is uncertain, slum improvement is politically complex, both for city planners and for residents. Any intervention on the part of government is perceived as a *de facto* recognition of legal status and any improvements by residents themselves are regarded as high-risk investments owing to the lack of property rights and the threat of eviction without compensation. Hence, in considering effective planning and management in the context of climate change, the overarching policy and legal climate regarding access of the tenure in the city is critical. Pro-poor enabling legislation and land regularization instruments are crucial components of a city's agenda on climate change.

Indicators of per capita building energy consumption, of urban transport and urban density, for example, can help to inform planners and city managers on policy at several scales. At the regional scale, for example, growth and transportation policies shape major infrastructure investments that affect residents' decisions to drive or take transit. At the city scale, comprehensive development plans can help by establishing density targets that affect transit services, energy systems, and land use. At the neighborhood scale, guidelines that promote mixed-use communities can enable people to walk or cycle to meet daily needs, and at the housing scale, they can encourage building forms and orientation that reduce heating and cooling loads (Miller *et al.*, 2008).

The planning profession and planning tools to promote safer and more resilient cities can contribute to local capacity.

[MITIGATION] Box 9.6 Tampere, Finland's climate change mitigation strategy: Addressing inter-municipal climate strategy

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Local climate policy took its first steps in Tampere¹ in the early 1990s. At that time, a local citizens' climate initiative, Tampere 21, was organized by local environmental and students' organizations. The initiative lobbied to put climate change on the local political agenda. As a result, the city adopted an environmental strategy in 1994, including a target to reduce greenhouse gas emissions within the city limits.

However, public attention and political commitment for climate action were not strong enough to sustain the issue on the agenda over the following decade. Since the 1990s, it has become evident that climate targets require sustained political commitment, and they cannot be achieved by sectoral programs only. Climate change cannot be an issue "owned" by the municipal environmental office. Furthermore, city limits are seen as too restrictive, and climate change mitigation efforts are now best addressed at the city-region scale.

Prompted by the legislation on restructuring Finnish municipalities, Tampere launched a climate strategy process jointly with seven neighboring municipalities in 2007. The present strategy is integrated with land use, traffic, housing, and municipal service, based on a set of land use and infrastructure development scenarios with respective greenhouse gas projections. The strategy seeks to produce an action plan assigning responsibilities, resources, and timetables, based on a framework agreement among the municipalities in the region. At present, Tampere has also committed itself through the EU covenant of mayors on climate change in 2009.²

The local climate strategy is complemented by the ILMANKOS project, which aims to promote the concrete participation of citizens and organizations in mitigating climate change. The project is split into two parts: a public involvement campaign and a research and development project monitoring and evaluating the campaign. The project is funded by the Finnish Innovation Fund (SITRA) and the city of Tampere. The research section is conducted by the Centre for Urban and Regional Studies, School of Engineering, Aalto University.

The ILMANKOS public involvement campaign seeks "to combat climate change and promote climate democracy." The first phase of the campaign has been active since September 2008. The aim of the ILMANKOS campaign is to activate citizens and organizations in the Tampere Central region to reduce greenhouse gas emissions and to take part in developing the climate strategy.

The campaign has organized thematic workshops for local organizations and citizens on issues such as housing and food, a panel on climate change for local politicians, and a lecture

series on climate change. Network building among stakeholders with different backgrounds and communication with other local climate change initiatives have been integral to the campaign. The emphasis has been on relating mitigation to everyday life practices. Also, a local climate fund has been created within the campaign, funding small-scale climate initiatives and projects of NGOs, communities, or non-profit organizations.

The research and development project has monitored the campaign through participant observation, documentation of the events, and interviews with key actors. The research project will continue into 2009–10 as a citizen-centered evaluation exercise of the Tampere climate strategy and the ILMANKOS campaign. It constitutes a form of action research, which feeds into the follow-up of the campaign and climate strategy work. The mid-term findings of the project indicate that the scope of local climate strategies has changed from a sectoral and city-centered perspective to encompass the broader region. Municipal actors are seen as central to the strategy, but there is also a clear recognition of the need for broader stakeholder involvement.

The Tampere Central Region's climate strategy and publicity campaign have proceeded on separate tracks. The strategy is expert-driven and operates at the level of inter-municipal planning and administration, while the campaign is citizen-centered and practically oriented, addressing everyday life issues. Despite the visibility of climate change in the media, there is still a clear need for public information and raising awareness of the topic. The need for basic information has been a slight surprise for the campaign project team. Intermediary groups and organizations have become recognized as crucial "gatekeepers" for climate change action. This has been a key lesson of the campaign. For instance, self-governed housing companies make key decisions affecting the climate impacts of housing, and catering companies are important gatekeepers for food-related greenhouse gas emissions.

Originally the ILMANKOS campaign was planned as a short-term public involvement campaign. However, the project team sees the need for a more long-term project to further develop the networks and initiatives launched during the campaign. The planned follow-up project will target specific intermediary groups such as inter-municipal climate envoys, "climate families," and self-governed housing companies. Another aim would be to engage groups that are marginalized in the public debate on climate change, for example immigrants. The local climate fund would continue independently.

Sources: Peltonen, L.; Roininen, J.; Ahonen, S.; Nupponen, T. and Tuusa, R. (2011). Ilmastomuutos ja kansalaisosallistuminen. ILMANKOS-hankkeen tutkimus- ja kehittämissosion loppuraportti. [Title in English: Climate Change and Citizen Participation. Final Report of the ILMANKOS Research and Development Project]. Sitran selvityksiä 45. The Finnish Innovation fund Sitra, Helsinki. Available electronically at: <http://www.sitra.fi/fi/Julkaisut/sarjat/selvityksia/selvityksia.htm>

¹ Tampere is a city with about 200,000 inhabitants, situated in inland Finland, some 180 kilometers north of the capital, Helsinki.

² The covenant is a political commitment for local authorities in EU countries to show their commitment to the ambitious mitigation targets of the EU climate policy. Moreover, the covenant authorities prepare a sustainable energy action plan of detailed measures through which the local authority attempts to reach the targets and reduce its CO₂ emissions. Even if authorities endorse the covenant, its focus is not only on public authorities but also on the local private sector. It also stresses the importance of citizen participation in reaching the objectives. (See www.tampere.fi/tampereinfo/tiedotus/tiedotteet/2009/t090210e.html.)

[ADAPTATION] Box 9.7 Climate-specific governance challenges faced in managing cities: A view from Durban, South Africa

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1. **There is tension between relatively short political and budgeting cycles at the local level and the long-term vision that climate change is requiring of city managers.** For example, 50–100-year planning horizons become necessary to ensure that short-term decisions do not foreclose long-term options and responses. This is a real challenge for urban governance as decision-makers battle to weigh the long-term resilience and sustainability needs of cities appropriately against short-term and more immediate needs. Addressing this disjuncture must be a critical part of any discussion around governance.
2. **In the past, cities have been planned for a fairly constrained set of predictable futures.** Climate change science requires planning for many possible and uncertain futures, and recognizing that the levels of uncertainty associated with these futures may increase. This poses a challenge for institutions to become very flexible and responsive. Such flexibility is not inherent in most local governance or government structures.
3. **Climate change, in many cities around the world, has first been picked up and championed by environmental departments.** It has therefore become stereotyped as an “environmental” issue and not understood as the developmental challenge that it actually is. This limits the ability to ensure that it is effectively mainstreamed into planning and decision-making.
4. **Local government has had limited standing, basically as an observer, in international climate change negotiations.** One of the goals for local governments to achieve in Copenhagen was acknowledgement of local government as a key implementing agent in addressing climate change. At COP16 in Cancun, Mexico, local governments were referenced in the shared vision for long-term cooperative action and in parts of the agreement regarding

adaptation and capacity building. They were specifically recognized as governmental stakeholders regarding future arrangements of the intergovernmental proceedings adopted by the Subsidiary Body on Implementation of the UNFCCC, and city-wide programs were included in Clean Development Mechanisms (CDM) studies. This helps from a governance perspective to ensure that national governments acknowledge cities as climate change players and puts local governments more effectively in line for the various international funds that are being discussed.

5. **The challenge of securing funding is particularly acute in terms of the difficulties that local government has in accessing international funds, both available and proposed.** The funding streams in terms of adaptation are particularly important to cities in the global south as they come to bear the brunt of climate change impacts. Cities therefore need access to new and significant funding for adaptation. Unfortunately, Article 4.4 of the United Nations Framework Convention on Climate Change (UNFCCC) clearly states that funding is reserved for the impacts of climate change. Since much of cities’ adaptation will be linked to adaptation of existing infrastructure, UNFCCC’s funding is not linked to existing adaptation goals. A funding system that links Official Development Assistance (ODA) and adaptation funding, or a realignment of adaptation funding for both existing and new risks, are possible suggestions for addressing this challenge, although they are not without complications.
6. **Residual damage is going to be a complicated challenge for local government.** There is a suggestion that up to two-thirds of the potential major losses from climate change cannot be averted, for example sea level rise, desertification, and ocean acidification, because adaptation is neither economic nor feasible (Parry *et al.*, 2009). This inevitability will place enormous pressure on local patterns of governance and government. Cities’ existing systems are not necessarily ready for this challenge.

However, most cities have limited planning capacity and resource commitments targeted to plan, prepare, and implement climate change response activities. Climate change action plans are often costly. The Chicago Climate Action Plan reveals the importance of securing a range of sustainable funding sources where a total of approximately US\$2.8 million was contributed by 14 sources from a variety of non-profit foundations, funds, trusts, and initiatives as well as pro bono services, Illinois and Chicago government departments, and regional councils (Parzen, 2008).

In addition, there is an information crisis that seriously undermines effective urban planning (McCarney, 2006). Monitoring and data systems are needed for good planning decisions in cities, particularly cities of the developing world. City planners in poor cities are increasingly concerned with reducing vulnerability to climate change, ensuring emergency preparedness in the event of health risks, creating environmentally friendly cities, creating

safer cities by re-designing public space, upgrading slums, and investing assets for pro-poor urban strategies.

Planners working in cities with appropriate resources can draw on toolkits to help decision-makers and the public understand the types of vulnerabilities that are present. Mapping tools in particular can be used to identify infrastructure, buildings, ecosystems, and populations that are vulnerable due their proximity to waterways, wetlands, floodplains, and other potential stressors (Prasad *et al.*, 2009). When combined with the development of scenarios that account for different climatic conditions and impacts such as landslides and floods, cities can use this information to set priorities and develop adaptation plans. The City of London has detailed three climate impacts in the London Climate Change Adaptation Strategy: heat waves, floods, and droughts, each considered as having both a high risk of consequence and vulnerability, as well as increasing probability (Mayor of London, 2008). The London heat wave of 2003, during which 600 residents died, was

a motivator for developing a strategy to adapt to and prepare for rising temperatures in the London area. Climate change scenarios have been developed by the Hadley Centre for Climate Prediction and Research that predict that London will see the increased frequency and intensity of extreme weather, as well as a rise in the number of “very hot” summer days. As a result of this data, then Mayor of London developed strategies to mitigate the effects of heat waves. Mayor Livingstone undertook an “urban greening program” that would utilize green spaces, street trees, and urban design to enhance the cooling potential of the city. The mayor also sought to create an “Urban Heat Island Action Area” in which new development would be used to offset the heat island effect. Facilitating access to cool buildings and developing design guidelines for developers and architects were also elements of the key action plan to manage London’s response to heat waves (Mayor of London, 2008).

London is prone to tidal flooding from the sea, fluvial flooding from the River Thames, surface water flooding due to the drainage system’s inability to handle heavy rainfall, flooding from sewers, and flooding as a result of rising groundwater. Using maps of London that include areas at risk of tidal and fluvial floods the Greater London Authority (GLA) determined that nearly 15 percent of the metropolitan area is at risk from flooding. As a result of this analysis, the GLA proposed a review of the London Strategic Flood Response Plan, as well as improvement of the standard of flood risk management in partnership with the Environment Agency. The urban greening program is also designed to help reduce flooding, as it will improve the permeability of the urban landscape. With rising temperatures comes the possibility of drought, and with each Londoner consuming an average of 168 liters of water per day, the GLA attempted to promote and facilitate the reduction of leakage from water mains, compulsory water metering, retrofitting of London homes, as well as the encouragement of rainwater harvesting and gray water recycling. The GLA proposed publishing a Water Strategy and a Water Action Framework that will achieve a sustainable water supply–demand balance (Mayor of London, 2008).

In wealthier cities such as London, areas identified as high risk can be zoned for zero construction or only for buildings that conform to a highly regulated and appropriate standard. While these regulatory steps might be obvious, their implementation is more difficult to achieve when high-risk zones are already occupied, and different uses, densities, and status of occupation exist (McCarney, 2006). This is particularly true in poorer cities. Poverty forces many people to settle in areas of high risk and return to hazard-prone lands that have already been struck by disasters (Satterthwaite, 2009). Decisions regarding densely populated high-risk zones are contentious and often costly.

One of the crucial ways to effectively mainstream climate adaptation is to link initiatives to development goals. However, this will inevitably lead to contradictions and the need to make tradeoffs between different priorities. Some of these tradeoffs are advancing risk reduction strategies versus affordability, promoting stricter residential building regulations for disaster

resistance and safety versus flexible standards for incremental housing development by the urban poor, and self-help community development of infrastructure versus adherence to universal standards of water and sanitation services designed to avert risks of contamination in crisis situations (McCarney, 2009). Even decisions that address pressing needs can result in inequitable outcomes. For instance, in seeking to find ways to ensure the long-term availability of water to the city in response to climatic events, Quito is faced with challenges of human rights and environmental justice. One of the most controversial projects would improve water delivery to the city by damming 31 rivers. The project has the potential to secure water for the city and suburbs. However, it also is likely to reduce the water resources on which Amazonian indigenous people who live in surrounding areas depend. Examples such as these begin to reveal the need for planning and policy methods that account for the contradictions and inequities that are inherent in measures designed to promote the development of climate-resilient cities.

9.2.4 The challenge of data and measurement: evidence-based policy formulation and monitoring

Cities worldwide are entering into renewed dialogues with state/provincial and national governments to discuss the urban agenda on climate change. Cities are also increasingly engaged in global discussions on climate change. In this context, more rigorous data-driven policy analysis by cities can mean leverage in intergovernmental relations and multi-level governance negotiations.

The vulnerability of cities to climate change is largely underestimated due to lack of standardized data and weak metrics at the city level. There is no established set of city indicators that measures the effects of climate change on cities and assesses those risks, nor is there a comprehensive set of indicators with a common, accepted methodology designed to measure the impact that cities have on climate change and the role that cities play, for example, in contributing to greenhouse gas emissions. The World Bank has defined indicators as performance measures that aggregate information into a useable form. Indicators provide a useful tool in the prospective sense for policymaking and also in the retrospective sense for assessing policy implementation. Indicators also offer assistance to policymakers by aiding in comparison, evaluation, and prediction.

One cluster of challenges relates to how best to localize measurements on climate change. First, cities are responsible for the majority of the world’s greenhouse gas emissions yet there is still only a very limited set of comparable measurements of climate change at the city level. While national and global measurements have advanced, a credible and globally standardized measurement for how cities impact climate change is needed. Second, and related to this, is the challenge for cities to also establish a common standard for mitigation targets that will help to lessen cities’ impact on climate change. Establishing such targets requires sound research by sector that can help cities to establish benchmarks against which to measure performance

[ADAPTATION/MITIGATION] Box 9.8 Climate action planning in Quito, Ecuador

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Located in the Central Andes of South America and surrounded by glaciers, Quito is highly vulnerable to the impacts of climate change. Between 1939 and 1998, the Andean region saw an increase in average temperatures of 0.11°C per decade against a global increase of 0.06°C per decade (The Government of Ecuador, UNDP, and Ministry of Environment, 2008). One impact associated with this change in temperature is that the Antisana glacier shrank by 23 percent between 1993 and 2005 (Maisincho *et al.*, 2007). This is a critical issue since this glacier and its nearby ecosystems supply a large portion of water to the city's 2.1 million inhabitants. Climate change also threatens to destroy the páramos ecosystems that regulate the hydrological system of the city's water basins. Furthermore, climate change is expected to intensify extreme weather events and rainfall in Quito. This is likely to exacerbate landslides and mudslides, stress transportation systems and infrastructure, and endanger indigenous and migrant populations living on the hillsides and slopes (Dirección Metropolitana Ambiental y Fondo Ambiental, 2008).

CLIMATE PLANNING IN QUITO

Planning for climate change in Quito was initiated in late 2006 when the former Mayor, Paco Moncayo, and the Metropolitan Council took the lead in organizing Clima Latino, a climate change conference for the Andean Community of Nations. The October 2007 event was meant to help governments in the region identify appropriate measures for climate mitigation and adaptation (Carmin *et al.*, 2009).

Climate planning became more concrete in January 2007 when Gonzalo Ortiz, a Metropolitan Councillor, gave a presentation to his fellow council members about the need for Quito to take heed of the data on temperature and glacial changes and develop a climate strategy that addressed mitigation and adaptation. With strong support from the Metropolitan Council and the Mayor, Ortiz was empowered to create an Inter-Institutional Commission. In fall 2007, the Inter-Institutional Commission presented its draft climate strategy for Quito to municipal agencies and, a few weeks later, to participants at Clima Latino. They also initiated a metropolitan-wide public consultation process as a means for identifying public concerns and suggestions for the climate strategy. After making revisions based on residents' priorities and ideas, the Inter-Institutional Commission finalized the Quito Strategy for Climate Change (EQCC) in February 2008.

PUBLIC PARTICIPATION IN CLIMATE PLANNING

The Inter-Institutional Commission in charge of the climate strategy hired the environmental NGO ECOLEX to coordinate

citizen consultation and organize four workshops across the city in November and December 2007. ECOLEX was asked to engage the local population, particularly vulnerable and historically marginalized communities, as well as key social and community development organizations.

The consultation process resulted in three central concerns being raised by participants. The first concern was the need to improve air quality in Quito. In response, the EQCC includes provisions for improving and extending the public transportation system as a means for decreasing car emissions. Second, was the need to protect homes and property on hillsides from landslides and extreme weather events. The response was to include stipulations in the EQCC for the development of early warning systems and improved emergency preparedness. Further, residents raised concerns about access to potable water, given the shrinking glaciers. This concern is reflected in the EQCC commitments to studying aquifers in Quito's nearby valleys in order to define a new strategy for using these subterranean resources and working with residents to increase efficiency in water usage.

PUBLIC PARTICIPATION IN IMPLEMENTING CLIMATE INITIATIVES

The Quito strategy gives civil society actors a central place in the implementation of climate adaptation measures. Local universities and research centers monitor climate vulnerabilities, especially around the Andean glaciers, and inform decision-makers of changes so municipal adaptation measures can be adjusted as necessary. In addition, some local NGOs received funding to train indigenous farmers to improve the management of water resources in their urban agriculture practices, diversify as well as privilege native crops, and replant native tree species in hillside areas. The NGOs also train indigenous leaders to monitor variations in rainfall and flows from local rivers so that municipal staff members receive up-to-date information on changes in water levels in Quito.

CLIMATE ACTION AS BRICOLAGE

The climate planning and implementation processes in Quito reflect a longstanding commitment that public officials have to ensuring that citizens can participate in decision-making and implementation of policies and programs. Many of the issues raised by residents reflected their concerns for health, environmental quality, security, and safety. Officials and staff addressed these concerns by linking elements of the EQCC to existing priorities for development, especially in the areas of water management, land use, and transportation. It is thus possible to envision climate action as a process of bricolage, one through which planners and public officials find creative ways to respond to the needs and concerns of local residents by linking mitigation and adaptation goals to existing municipal priorities and programs.

in moving towards these targets. Ideally, these benchmarks are established with a globally comparative methodology so that global progress can also be measured in a standard format. A third set of measurement challenges relates to cities and climate change adaptation. Research on risk and vulnerability of cities to climate change needs to inform citizens and policymakers across specified categories of risk at the city level. Data by category of risk and varying degree of vulnerability can then lead to an informed policy agenda on climate adaptation and emergency preparedness.

A second set of challenges for data and improved research on cities and climate change is associated with establishing a globally comparative, standardized set of measures through common methodologies. Climate change is often monitored at global and national levels according to an adopted set of measures globally agreed upon by states. However, similar statistics are rarely collected at the city level and devising indicators on climate change at the city level is proving difficult. Furthermore, when individual cities collect and monitor data on climate change, the information is often collected using methodologies different from other cities and is analyzed and reported on in different ways. This creates further challenges for researchers, planners, and city managers when drawing comparisons across cities globally. The lack of a standardized methodology for devising indicators on climate change at the city level greatly affects the quality of research, planning, and management.

The Global City Indicators Facility (GCIF), first initiated by the World Bank and now managed at the University of Toronto, provides indicators that can assist cities with their mitigation and adaptation efforts in climate change. The GCIF has various indicators, for example, on modal shifts from road transport to rail and public transport and non-motorized transport; waste incineration; wastewater treatment and recycling. Indicators on cities and greenhouse gas emissions are being developed to help create a standard and globally recognized index on cities and greenhouse gases. More research and development of city indicators related to climate change is required. For example, measures to assess mitigation strategies in the energy supply sector, including indicators on renewable energy resources as well as the monitoring of industry practices in cities, need further development. With regard to mitigation strategies in the buildings sector, LEED certification has been a leader in promoting environmentally friendly buildings, and means to assess improvements will help to further transform the building industry.

Indicators on adaptation strategies can help cities assess progress in addressing climate change and areas requiring improvement. With regard to infrastructure, standards and regulations that integrate climate change considerations into design are as yet underdeveloped and measures of performance are not yet identified. In addition, specific land use policies for climate adaptation have not been well addressed. In the health sector, research is required on climate change health impacts necessary for informing local health policy, such as in creating

heat-health action plans. Indicators are also needed to monitor climate-sensitive diseases. More generally, the ability of health services to cope with climate change associated health risks is under-researched. The issue of energy demand (particularly in warmer cities), is shown here to be potentially very significant, especially in economic terms, and this should also be a priority (Hunt and Watkiss, 2007). Climate change impact assessments on water scarcity in cities and how cities can best create adaptation responses warrants further research, and the design of impact measures is needed. Generally, in this evolving field of climate change adaptation at the city level, much more work is needed on creating standardized methodologies for measurement of impact assessment and on the evaluation of adaptation responses including the economics of adaptation (Hunt and Watkiss, 2007).

In establishing greenhouse gas reduction targets, cities have an important role to play in helping to determine an equitable distribution of reduction targets, which will help to frame mitigation strategies on climate change. Current debates on per capita emissions between inner city residents and suburban residents, between large city residents and smaller city residents, and between wealthy cities and poorer ones raises issues of equity in sharing the burden in meeting reduction targets. However, measures are weak, and an accepted methodology for determining an equitable distribution of high-level greenhouse gas reduction targets has been established (Miller *et al.*, 2009). While it is generally assumed that suburban residents emit significantly more carbon dioxide than inner city residents, it could thus be concluded that it would be more equitable to require suburban communities to shoulder greater burdens for reductions (Miller *et al.*, 2009). However, credible indicators on this issue are still to be refined. For example, while some estimate that suburban dwellers produce up to three times more greenhouse gases per capita than inner city dwellers, recent data (Glaeser and Kahn, 2008) suggest that this dichotomy is not so simple. They report that while per capita emissions indeed rise as you move away from the urban core of Boston, they level off once you are more than ten miles from downtown. Another exception they have found is with respect to Los Angeles, where emissions are actually lower in suburban LA than they are in the central cities of that metropolitan area. Such issues are complicated further by considering the challenges and opportunities of high-growth versus low-growth communities, as well as questions of per capita versus total reduction targets. In Canada, for example, the Province of British Columbia plans to negotiate with local governments with the goal establishing an equitable allocation on a municipality-by-municipality basis.

Finally, a new set of indicators on climate change mitigation are also needed if policymakers are to assess the capacity in communities for greenhouse gas reductions and what costs related changes would generate – physically, socially, and economically – before they can act. Policymakers need to know, for example, how redesign, modified urban form, and rebuilding of the suburbs might overcome car dependency (Miller *et al.*, 2009).

The use of proximity-to-target methodology that quantitatively measures city-scale performance against a core set of goals, while useful in theory for measuring the distance between a city's targets and current results, providing an empirical foundation for policy benchmarking and providing context for evaluating city performance, is as yet under-developed for climate change indicators at the city level. Nonetheless, it could serve as a powerful tool for steering policy and assessing climate planning and investments in city management.

Advances have been made in environmental performance measures and empirical approaches to assessing global sustainability. The Environmental Performance Index (EPI) developed by the Yale Center for Environmental Law and Policy at Yale University and the Center for International Earth Science Information Network at Columbia University has developed 25 indicators across six policy categories that quantitatively measure country-scale performance on a core set of environmental policy goals. Country-level data and analysis on climate change have improved in recent years, but serious gaps still exist at the city level. Quantitative city data on climate change are being developed by cities in some discreet form, often adapted from these broadly accepted national level methods. However, limited availability of discrete and time series data on cities and climate change hamper efforts to diagnose emerging risks and problems, to assess policy options in terms of both mitigation and adaptation strategies, and to gauge the effectiveness of city-level programs. Moreover, globally comparative indicator-based knowledge on cities and climate change is underdeveloped. Standardized indicators on climate change that allow cities to compare themselves globally are useful not for purposes of numerical ranking of cities, but for informing policy decision-making through comparative city data that leverage policy and political strategy (McCarney, 2010).

Building and adopting indicators on climate change can promote more open and transparent governance systems in cities and foster increased citizen engagement. In a review on urban sustainability indicators, Mega and Pedersen (1998) suggest that indicators should aid in decision-making at various levels to promote local information, empowerment, and democracy. They should also contribute to making the city a more important instrument for fostering citizen participation. As with indicators of sustainability, those that focus on climate change mitigation and adaptation can ensure the availability of current information about climate performance and improve policy development and implementation.

Evidence-based policymaking is made possible by advances in information technologies. Data-driven decision-making in the government domain via quantitative performance metrics can serve to measure implementation success rates, steer investments, and refine policy choices. The Global City Indicators Facility (GCIF) provides a system for cities to use globally standardized indicators as a tool for informing policymaking through the use

of international comparisons (McCarney, 2010). For example, the Secretariat of Finance in Bogota uses indicators from the Global City Indicators Facility to track the city's investments and to compare performance relative to other cities. By using indicators and such comparisons, the Secretariat of Finance "is able to evaluate and monitor performance on their investments and to benchmark their performance in comparison to other cities."¹ Similarly São Paulo is demonstrating how governments can use indicators to enhance governance and institute evidence-based policy development city.² They report: "the media and civil society are often skeptical of government statistics. As an active member in this global initiative (the GCIF) supported by universities and international organizations, the government of São Paulo is hoping to regain legitimacy and public confidence in government statistics by creating more transparency on its performance in city services and on improving quality of life. The Government of São Paulo recognizes the growing importance of indicators for planning, evaluating and monitoring municipal services. For example, the GCIF indicators were used during the public participation process in preparation of the City's Master Plan, Agenda 2012. The use of indicators to assist with public policy making in São Paulo has opened more effective dialogue between civil society and the local government."

When indicators are well developed and soundly articulated, they can also influence how issues are constructed in the public realm. This is an important lesson related to cities and climate change since information can help to direct behavior in building climate action. Behavioral change can result from publicly accessible information by becoming embedded in the thought and practices, and institutions of users (Innes, 1998). Hezri and Dovers (2006) argue: "as a source of policy change, learning is dependent on the presence of appropriate information with the capacity to change society's behavior" and "community indicator programs or state-of-the environment reporting are usually aimed at influencing the social construction of the policy problem". City indicators on climate change can therefore enhance understanding of the risks associated with climate change, influence opinion and behavior, shape policy, determine priorities, and thereby impact a city's relative contribution to global climate change.

9.2.5 Addressing deeper and enduring risks and long-term vulnerabilities in cities

It is important when addressing climate change risk in cities that a broader framework of risks confronting cities be considered. Cities in the twenty-first century are facing unprecedented challenges. The world's urban population is likely to reach 4.2 billion by 2020, and the urban slum population is expected to increase to 1.4 billion by 2020, meaning one out of every three people living in cities will live in impoverished, over-crowded, and insecure living conditions (McCarney, 2006). Social cohesion, safety, security, and stability are being tested by social exclusion, inequities, and shortfalls in basic services.

1 Interview and case study material gathered from City of Bogota: Finance Secretary, 2009.

2 Interview and case study material gathered from City of São Paulo, 2009.

The goal of promoting urban climate resilience is to ensure that settlements are vital and viable into the future. This means that climate change mitigation and adaptation are integral to a larger program of environmental, economic, and social sustainability. From a social point of view, climate resilience reflects the ability that individuals and groups have to adapt to climatic changes and impacts. The ability to cope is related to the availability of resources, particularly financial assets, political power, social status, and personal and professional networks (Adger, 2006). Some people will have the resources to relocate, retain their livelihoods, and maintain their social networks as situations change; however, others will not have the capacity to adapt. For instance, the elderly and infirm may not have the financial or familial resources needed to relocate to new residences. Those who are socially isolated may have difficulty adjusting to the disruptions around them, and individuals who do not speak the official state language may be unable to fully grasp impending threats. While there are many vulnerable populations in urban areas, the poor are at tremendous risk from climate impacts (Carmin and Zhang, 2009).

Poorer urban households are usually more vulnerable due to weaker structures, less protected city locations and building sites, and lack of resilient infrastructure to withstand climate damages. Similarly, the relation between urban health and climate change risks is particularly heightened under conditions of urban poverty in cities. When basic infrastructure is inadequate, existing conditions of poor sanitation and drainage and impure drinking water are further stressed under conditions of extreme weather events and flooding, leading to the transmission of infectious diseases, which puts poor urban households at high risk. This situation is worsened under circumstances of higher densities in urban areas. Cities in developing countries are disproportionately affected for similar reasons of vulnerability and weak institutional support and infrastructure systems (McCarney, 2006). For example, many developing countries lack the health facilities to deal with large numbers of injured patients, resulting in higher death tolls than in countries better equipped for disasters (See chapter 7). Some disasters, which may become more frequent, can paralyze entire cities and regions and permanently destroy their social and economic assets. Leadership in the governance arena is required for the adoption of sound policy on climate resilience in cities, more effective urban management of risks, and more empowered governance at the city level.

“The world Urban Forum III found that severe consequences and threats that cities are now facing as a result of climate change, pressing shortfalls in urban water, sanitation and waste management services, inadequate housing and insecurity of shelter, and the deteriorating quality of air and water in city environments, are being experienced in a context of intense urban growth of cities that increasingly manifests deepening poverty and income inequities, socio-economic exclusion (McCarney, 2006, p.8).”

The adoption, in the year 2000, of the Millennium Development Goals (MDGs) by the UN Member States documents the commitment by the international community to support the

development of the poorest regions of the world and to assist the most vulnerable. All eight of the MDGs can be directly connected to the theme of vulnerability in the world’s cities. Indeed, it is the world’s cities and the slums within them that are pivotal platforms for the successful achievement of each MDG (McCarney, 2006). Goal 7 – to “Ensure Environmental Sustainability” – sets out three targets: to reverse the loss of environmental resources; improve access to safe drinking water; and improve the lives of slum dwellers. Linking these three targets helps to frame the challenges cities face in addressing climate change in a context of poverty.

Reducing poverty is a core challenge for urban governance and in turn addressing the deficiencies in urban infrastructure and services and sub-standard housing of slum dwellers is central to climate change adaptation. The poor have difficulty obtaining provisions and services and often are at risk of illness and death due to their compromised health and nutritional status. These factors will be heightened as climate conditions change and the poor are exposed to greater heat and humidity, higher incidence of disaster, and changing disease vectors (Kasperson and Kasperson, 2001). Urban poor who maintain subsistence lifestyles may find that they are unable to obtain fish from local waterways or fruits and vegetables from open plots as habitats and growing conditions change (Huq *et al.*, 2007).

The situation of poverty in cities worldwide, but in particular in the less-developed regions, must be recognized as a core conditioning factor in addressing climate change and building more climate-resilient cities. This means explicitly recognizing that climate change adaptation must in tandem reduce the vulnerability of the poor in cities. To date, there are few examples of climate adaptation policies and best practices that focus on the needs of the poor or other vulnerable urban populations. However, many development and aid agencies are recommending that climate adaptation activities be aligned with pro-poor development policies. This includes ensuring that the risks to vulnerable populations are minimized and that efforts are made to enhance their capacity for independent action.

9.2.6 The challenge of inclusive governance

Cities worldwide, whether rich or poor, confront the challenge of civic engagement and how to foster an inclusive governance process in their local political environment. Governance invokes more than just political strategy; it demands attention to differentiated social circumstances and needs within the community, to accommodate different cultural values and diversity, and to engage the private sector in the governance platform on climate change.

Social cohesion, safety, security, and stability are being tested by social exclusion, inequities and shortfalls in housing and basic services in cities worldwide. Risks associated with each of these conditions are critical factors in assessing urban risks associated with climate change. Building inclusiveness in local government models is critical to overcoming the core hindrances to social and economic development for citizens.

An inclusive city government that involves long-term residents, international migrants, the poor, marginalized groups, national minorities, and indigenous peoples is fundamental to building safe, livable and climate-resilient cities. The development of new policies and mechanisms for local governance is rooted in strong grassroots participation, citizens and community groups equipped with the understanding of democratic governance to hold local and more senior levels of government accountable, the poorest and most isolated communities' representation in the public debate. Addressing risk in cities depends on a deeper understanding of the relationship between civil society and the state and the cultural competency of local government.

Inclusiveness is a key means of deepening democracy and promoting citizen involvement and social cohesion. When citizens are effectively engaged in their city's development, engaged in everyday decisions and in longer-term planning and policy development, they develop a sense of ownership of and loyalty to the city. So too are citizens more apt to embrace an action agenda on climate change if they are given such opportunities to lay claim to that agenda. If people feel more empowered to shape their own destinies in the city while embracing and participating in forging a common agenda such as climate change, then not only is governance being strengthened but that agenda is more likely to gain political traction.

Engaging citizens in the running of their city has taken many different forms. Typical forms of participatory governance include public consultations, public hearings and meetings, appointing citizens to advisory bodies inside municipal authorities, and designing community councils with stakeholder voice at municipal council sessions. These approaches are being extended to climate mitigation and adaptation efforts. While climate initiatives require the commitment and engagement of local governments, projects and programs driven by non-governmental organizations and communities are starting to emerge as important tools for promoting climate readiness. Environmental organizations have long histories of working on issues now defined as climate mitigation related, such as alternative energy, transportation, and green design. Their ongoing work in ecosystem and natural resources management, as well as the concerns many have about environmental justice, now serve as bridges to adaptation. International development and humanitarian aid organizations traditionally work in the areas of health, human services, and disaster and conflict preparedness and response. Many of these organizations are extending their efforts in these domains to account for changing disease vectors, resource conflicts, and water and food scarcity anticipated to result from climate change (Reeve *et al.*, 2008).

In addition, local citizen groups are also serving as drivers of mitigation and adaptation planning. This has been the case, for instance, in the city of Tatabanya, which is about 50 kilometers from Budapest. The residents of this former mining and industrial town formed a Local Climate Group made up of diverse individuals. In addition to working on an integrated mitigation and adaptation strategy, they have implemented a heat and UV alert program,

organized teams to assist in the development of a local climate strategy, initiated a call for proposals on energy efficient housing, established emissions reduction targets, and implemented educational and information programs (Moravcsik and Botos, 2007).

Governments are critical actors in advancing mitigation and adaptation. However, an emerging approach being used to support government adaptation initiatives is community-based adaptation (CBA). CBA is based on the premises that vulnerability to the impacts of climate change can be altered by drawing on local capacity and that local communities have the ability to assess conditions and foster change. CBA is distinguished from other participatory and collaborative approaches because it takes climate assessment and adaptation as its primary focus (Jones and Rahman, 2007). While CBA has been attempted at limited scales and often in rural locales, it has the potential to be a valuable asset in an urban climate adaptation toolkit.

Valuable research has been undertaken on recent experiments involving citizen engagement in their city's climate change development programs. Case studies on worldwide models of urban governance provide a base for considering next best steps in addressing inclusiveness in cities as they inform a deeper awareness of the intersection between civil society and government and improve our understanding of potential new institutions and paths necessary for fostering inclusiveness, empowerment, and engagement in cities globally (McCarney, 1996).

Finally, engaging the private sector in building climate resilient cities is critical if a city's climate-ready development programs are to gain traction. The private sector plays an important role in urban development and service delivery. Many of the critical urban services that are vulnerable to climate impacts are also privately owned and operated (e.g., water, power, transportation, infrastructure, and occasionally emergency preparedness). In order to be effective, efforts to increase the resilience of these services must include the private sector. Strong cooperation between private operators and public authorities is vital in order to build sustainable cities.

Cities, as centers of commerce, are vulnerable when businesses are adversely affected by climate change. In many countries the private sector is the biggest employer and a significant contributor to national income. The resilience of these businesses is critical to the cities in which they are located. The private sector is likely to be affected by physical exposure to a changing climate, regulatory risks around emissions reduction targets, competition from better-adapted businesses, and by litigation risks or risks to reputation (Llewellyn *et al.*, 2007). Businesses are increasingly aware of the potential impacts of a changing climate on raw materials, supply chains, asset design and performance, markets, products and services, and workforce health and safety (Firth and Colley, 2006).

The insurance industry, for example, has been at the forefront of business activity in assessing climate risks and opportunities, and the sector is already developing risk management processes

to minimize costs arising from events driven by climate change. Many insurance companies are actively raising the profile of climate change as a business risk rather than an environmental issue. The Association of British Insurers assessed the financial risks of climate change and warned of the risk of increasing tropical storm activity and its economic impact prior to Hurricanes Katrina and Rita. In the United States, the national insurance regulator has adopted a mandatory requirement for insurance companies to disclose the financial risks they face from climate change, as well as actions the companies are taking to respond to those risks. Other sectors likely to be affected by climate change include utilities, oil and gas, mining and metals, pharmaceuticals, building and construction, and real estate, due to their reliance on global supply chains and large fixed assets. The inter-linking of international capital markets means that businesses – and the cities in which they are located – are vulnerable to climate risks globally as well as domestically (Clarke, 2002).

Inventing new norms of practice and reforming institutional procedures in cities can effectively enhance civil society and private sector involvement and create a politics and culture of inclusiveness that is essential in framing strong local governance for effective climate action in cities.

9.3 Conclusion

In conclusion, the six core governance challenges for cities in confronting climate change can be summarized as: one, a more empowered local governance in both political and fiscal terms; two, addressing jurisdictional boundaries so as to build metropolitan governance systems to better address climate change; three, establishing more effective planning and urban management practices; four, addressing data and measurement through evidence-based policy formulation and monitoring; five, addressing deeper and enduring risks and long-term vulnerabilities in cities, especially related to poverty; and, six, building more inclusive governance. From the discussion of these core challenges, four key ingredients for successful climate action emerge. These are as follows:

1. **Effective leadership** is critical for overcoming fragmentation across departments and investment sectors when building consensus on the climate change agenda in cities. Strong leadership can overcome individualism and competition across political “turf” and build recognition that more metropolitan-wide collective action is empowering at both a national and international levels. The ability to build consensus and coordination better facilitates investments in infrastructure and amenities that make the city more resilient to climate change. Strong leadership in the affairs of metropolitan governance means not only building consensus, but also aggregating these fragmented interests in a way that builds legitimacy and accountability to stakeholders in the process.
2. **Efficient financing** is a core requirement for empowered governance in cities. Success to date with efforts to confront

climate change challenges in cities has been hampered due to deficient financing tools at local levels of government. The redistribution of responsibilities between different levels of government has not always been sustained by a corresponding allocation of resources or empowerment to adopt adequate financing tools to raise these resources. If these weaknesses are common at the level of individual municipalities, then the problems of raising finance to support the broader metropolitan areas are compounded. Highly fragmented governance arrangements in many metropolitan areas makes efficient financing for area-wide climate mitigation and adaptation strategies a difficult and on-going challenge. Metropolitan authorities often lack adequate resources for governing and face difficulties in raising new sources. Without a clear, permanent, and sufficient financial mechanism it is indeed quite difficult to implement the principle of territorial solidarity in the metropolitan area in order to redress social and economic inequalities in search of more climate-resilient cities.

3. **Inclusive citizen participation.** Different models of city governance can encompass different forms and degrees of citizen participation. Participation of citizens in decision-making and in the allocation of resources is challenging when principles of transparency and democracy require that the mechanisms of participation are accessible, easy to understand, and utilize simple forms of representation. Community-based adaptation strategies on climate change, transparency in climate change data on cities, and more inclusive local government planning help to build stronger involvement of urban citizens on the climate change agenda.
4. **Jurisdictional coordination** is one of the most pressing challenges common to cities worldwide. This challenge takes two forms: multi-level jurisdictional coordination of services vertically across multiple levels of government and inter-jurisdictional coordination of services horizontally across the metropolitan area. In the case of the former, the inter-governmental relations involved in the governance of cities are often in flux, with extensive and complex decentralization processes in motion in many countries worldwide. Multiple tiers of government and various levels of state agencies are involved in the climate change agenda and vertical coordination is often weak or non-existent. In the case of the latter, existing governing institutions are often horizontally fragmented, uncoordinated, and in many cases ad hoc when it comes to climate change strategy, due to multiple jurisdictional and electoral boundaries that span the territories of vast metropolitan areas. Coordination is fundamental not only in basic sectoral areas such as land, transport, energy, emergency preparedness, and related fiscal and funding solutions, but in addressing issues of poverty and social exclusion through innovative mechanisms of inter-territorial solidarity. Land-use planning across these broad urban regions is a key criterion for effective governance in the arena of climate change strategies. Territorial and spatial strategies are central in addressing climate change risks and building effective mitigation and adaptation strategies. Land use planning in peri-urban areas and the broader hinterland of cities and transport and related infrastructure planning at urban and

regional levels that emphasize territorial or spatial strategies are key functions of metropolitan institutions. Managing transportation in large metropolitan areas is essential for the advancement of the climate change agenda and addressing greenhouse gas emission targets. Transportation investments and services, however, are often implemented, financed, managed, and regulated by different governing institutions and levels of government. Coordination of these processes relies on complex inter-governmental policy networks and organizational management.

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Conclusion: Moving forward

Scientists and stakeholders: Key partners in urban climate change mitigation and adaptation

This volume is focused on addressing an urgent demand on the scientific community to provide new and timely information about how climate change is already affecting and will continue to affect urban areas, and how cities are responding to the challenge. Decision-makers need to know how hot their cities will become, how hydrological regimes may change, and the most effective ways to both adapt to and mitigate climate change, among many other questions.

One way forward is the creation of a process embodied by this report through which urban researchers can, over time, provide updated information and data to city decision-makers. Such an effort provides a similar science-based foundation for cities that the Intergovernmental Panel on Climate Change (IPCC) provides for countries. The Urban Climate Change Research Network (UCCRN) is an international coalition of researchers linking scholars and policy-makers in cities of all sizes throughout the world, focusing on cutting-edge science, science-policy linkages, and local mitigation and adaptation capacity. The UCCRN brought together approximately 100 authors from more than 50 cities to create this volume. In many ways it serves as both a touchstone of the current state of urban climate change science, and as precursor of even more comprehensive, integrative and collaborative work in the future. We are not alone in undertaking this work, however. Other scientific initiatives with a similar focus on cities and climate change include the ten-year Urbanization and Global Environmental Change (UGEC) project of the Human Dimensions Programme, established in 2005. The UN-Habitat's 2011 Global Report on Human Settlement also focuses on climate change and cities.

Building on these efforts, we hope that they could coalesce into an on-going series of ARC3 assessments by urban climate change researchers from small, medium, large, and mega-cities in both developing and developed countries. The ARC3 assessments would respond to the needs of urban decision-makers for practical and timely information on both mitigation and adaptation. At the same time they would provide the critical benchmarking function that will enable cities to learn over time as climate change and climate change responses unfold.

On the policy side, we see as strong allies governmental and stakeholder organizations that seek to motivate and support city-level action. The climate-related work of ICLEI-Local Governments for Sustainability, the C40-Large Cities Climate Group, the World Mayors Council on Climate Change, United Cities and Local Governments, the World Bank, UN-Habitat, and the OECD are all playing major roles in encouraging mitigation and adaptation efforts by local governments around the world. Putting emerging climate science into practice also has experienced significant forward movement as city leaders have been willing and able to take direct action to reduce greenhouse gas emissions, protect their cities against climate change impacts, and make their cities more sustainable. Evidence of this is documented time and again in this volume.

The UCCRN welcomes readers of this volume to directly comment on the usefulness of the information and areas for potential improvement, and to define their potential interest in contributing to the next report. Widening the network of linked collaborators and stakeholders will not only strengthen future research, it will expand opportunities for bringing cutting-edge science to bear as cities – the first responders – take action on climate change challenges

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