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URBAN CLIMATE ADAPTATION AND LEADERSHIP:
FROM CONCEPTUAL UNDERSTANDING TO PRACTICAL ACTION

JoAnn Carmin, David Dodman and Eric Chu [1]

ABSTRACT

The impacts of climate change are expected to create numerous challenges for cities. This report synthesizes key points raised in a series of discussions among "adaptation leaders" from fourteen cities around the world. Critical issues for urban adaptation that emerged from the discussions include the need for political commitment at multiple levels of government, information and data as a basis for understanding potential risks and vulnerabilities, meaningful and effective stakeholder engagement shaped by local contexts, and sustained financial and staff resources that are sensitive to urban variability. Further, the findings highlight how policy-makers and international organizations working with cities on issues of adaptation and resilience must support and facilitate processes of testing ideas, learning from experiences, and recalibrating as new information is obtained and lessons are learned.

JEL classification:

O19 International Linkages to Development; Role of International Organizations
O20 Development Planning and Policy: General
O21 Planning Models; Planning Policy
O22 Project Analysis
Q51 Valuation of Environmental Effects
Q52 Pollution Control Adoption Costs; Distributional Effects; Employment Effects
Q53 Air Pollution; Water Pollution; Noise; Hazardous Waste; Solid Waste; Recycling
Q54 Climate; Natural Disasters; Global Warming
Q55 Environmental Economics: Technological Innovation
Q56 Environment and Development; Environment and Trade; Sustainability; Environmental Accounts and Accounting; Environmental Equity; Population Growth
Q58 Environmental Economics: Government Policy
R00 Urban, Rural, Regional, Real Estate, and Transportation Economics: General

Keywords: Climate change adaptation, Urban planning, Urban governance, Urban development, Partnerships and participation

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In Spring 2011, a small group of urban adaptation leaders from around the world gathered at the Rockefeller Foundation Bellagio Study and Conference Center. We appreciate that these individuals took time from their busy schedules to attend this meeting and for being willing to candidly reflect on their experiences and share their insights and ideas. Although there were not a large number of participants, it took a great deal of time and effort to ensure that the logistics were in place and the meeting ran smoothly. We are grateful to the organizations and individuals that provided that financial support and administrative assistance that made the meeting possible. In particular, representatives from the Rockefeller Foundation created the opportunity for the meeting to take place and staff members at the Bellagio Study and Conference Center created a nurturing environment and ensured that every aspect of the meeting ran smoothly. The United States National Science Foundation supported data collection and analysis as well as travel for U.S. participants. The International Institute for Education and International Institute for Environment and Development funded travel for the remaining participants and facilitators. The meeting would not have been possible without the administrative guidance and support provided by Peggy Bryan, Nina Tamburello, and Karen Yegian from the Department of Urban Studies and Planning at Massachusetts Institute of Technology. In addition, we thank Isabelle Anguelovski, Jan Corfee-Morlot, Paul Fleming, Lamia Kamal-Chaoui, David MacLeod, Alexis Robert, Debra Roberts, Linda Shi, and Carl Spector for providing helpful comments on earlier versions of this report.

EXECUTIVE SUMMARY

The impacts of climate change are expected to create numerous challenges for cities. To prepare for greater variability in temperature and precipitation, sea level rise, and increased intensity and frequency of natural hazards, urban areas will need to secure existing infrastructure and buildings, identify ways to protect biodiversity, natural resources, and environmental quality, and ensure that local services and the health and well-being of local populations are maintained. Although there is growing recognition that cities need to make concerted efforts to prepare for climate impacts, many city officials are finding that advancing an adaptation agenda is challenging. They may encounter skepticism or find that adaptation is not viewed as a priority issue. Further, those that are taking action find that they have no tested models to follow. As a result, there continues to be a need for information, resources and institutional support that will enable cities to develop robust adaptation programs.

This report presents a synthesis of key points and views raised in a series of focused discussions among "adaptation leaders" from fourteen cities around the world. These "adaptation leaders" met at the Rockefeller Bellagio Study and Conference Center in Spring, 2011 and explored motivations and enabling conditions for initiating and sustaining adaptation, dealing with scientific uncertainty in their planning and implementation, ways of engaging different government departments and stakeholder groups, planning processes they follow, and the resources they need to advance adaptation. The meeting provided this small group with the opportunity to collectively reflect on their experiences and to learn from each other. At the same time, these discussions generated insights and lessons that are relevant to international, national, and local decision makers around the world. The findings are therefore relevant to city leaders who wish to understand the scope for acting to address climate change, local and national policy-makers who intend to support or facilitate this process, and international organizations that work with cities on issues of adaptation and resilience.

A critical issue that emerged from the discussions is that adaptation in cities requires commitment from political leadership at multiple levels of government. International and national policies foster regional and local action, including providing avenues for finance and ensuring that plans are developed and implemented. Absent national mandates, committed and visionary municipal leaders have also provided the impetus for action and a foundation for promoting engagement and coordination across city departments. However, participants noted that national political and financial support is critical for the long-term stability and success of programs, and the widespread adoption of adaptation initiatives. To date, this support continues to be lacking in many cities represented at the meeting.

The participant cities emphasized that understanding risks and vulnerabilities is integral to adaptation planning. While traditional approaches to planning focus on historical trends, adaptation must draw on climate projections to anticipate future conditions, impacts, and vulnerabilities. Some cities are producing dedicated risk or vulnerability assessments while others are drawing on regional data to understand general trends or commissioning detailed analyses in high priority sectors. No matter what approach they are taking, various actors from these cities understand that they need information and data as a basis for understanding potential risks and vulnerabilities. At the same time, they also recognize that these projections are uncertain. Rather than see uncertainty as a stumbling block, leading cities appreciate that knowledge will continually evolve and, therefore, they make plans and take action while striving to build flexibility into their adaptation programs and measures.

Cities are adopting diverse approaches to adaptation planning and implementation. These range from developing general climate action plans that include a section on adaptation to creating adaptation strategies to preparing dedicated sector-based plans to integrating adaptation measures into sector plans or activities. In order to support plan development and implementation, many cities are forming advisory committees comprised of different types of stakeholders as well as holding public meetings and seeking expert advice from state and regional agencies, utilities, universities, and research organizations. Those at the meeting acknowledged the importance of stakeholder engagement, but they also highlighted that the specific groups to be engaged needs to be shaped by the local context, and that care should be taken in the way these interactions are organized if they are to be meaningful and effective. They also recognize the central importance of political dynamics – and the need to negotiate these – as a basis for shaping the ways in which adaptation planning and implementation unfold.

In communicating information and seeking to build cross-sector engagement, most of the leaders actively strive to identify synergies between adaptation and citywide and departmental agendas and goals. Integrating adaptation with other agendas and with routine activities makes it possible for city staff to more readily integrate consideration of climate impacts into existing efforts. At the same time, the distinctive features of adaptation need to be acknowledged so that staff members understand why this is an important issue and are prepared for unique challenges and complexities they will face.

The availability of resources, particularly funding, affects the ability to plan and implement adaptation measures. However, the leaders noted that funding for large-scale projects is generally unavailable and, in some instances, national government timelines do not align with municipal budget cycles. High levels of staff turnover and limited resources for ongoing training, which are particularly common problems in developing countries, also can hinder planning and ongoing adaptation action. This challenge can be addressed, at least to some extent, by encouraging ongoing professional education and promoting participation in regional, national, and global networks.

The discussions among the adaptation leaders highlight that, despite the presence of some regional variation, a number of fundamental measures still need to be put into place in all parts of the world in order for cities to effectively initiate and sustain adaptation. Central to advancing adaptation is the need for policy and financial commitments from national and international decision makers and access to current climate data. The reporting and monitoring requirements that accompany resources need to be designed so that they support, rather than thwart, adaptation efforts. Cities are diverse and, while international and national programming can catalyze adaptation efforts, they need to be sensitive to urban variability. Supporting rigorous studies of adaptation that investigate and compare independent efforts and international programs will lead to more nuanced understandings of what approaches are most successful in different contexts that, in turn, can support the creation of adaptation programs and guidelines that both reflect and promote initiatives that are context specific.

For urban adaptation initiatives to take root and be successful, local leaders need to demonstrate that they are committed to this agenda. However, much of the effort to advance adaptation rests with local government departments. Therefore, cities may find it helpful to designate a point person from each department as this can promote communication and coordination while facilitating the integration of adaptation into existing programs and ongoing activities. Finally, it is important to recognize that transforming a city is a highly dynamic and complex process that requires testing ideas, learning from experience, and maintaining a willingness to question and recalibrate as new information is obtained and lessons are learned.

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SECTION I: INTRODUCTION

Climate change is expected to place increased stress on urban infrastructure, buildings, biodiversity, environmental quality, and local services in urban areas. Already, some cities are coping with water shortages while others are dealing with storm surges and variability in temperature. Over time, it is anticipated that the emergence of new weather patterns will continue to overwhelm infrastructure, threaten urban plant and animal life, alter the habitability of many buildings, and lead to increases in illness and death among vulnerable populations (Adger *et al.*, 2003; Dodman and Satterthwaite, 2008; OECD, 2010).

Minimizing the impacts that climate change will have on cities and their inhabitants requires that urban municipalities make concerted efforts to protect natural systems, the built environment, and human populations. In response to this need, a variety of intergovernmental organizations, NGOs, development professionals, urban consultants, and funders are working to generate and disseminate information about best practices to representatives of municipal governments and departments. Despite growing recognition of the need to promote adaptation, efforts to generate information and ideas, and the creation of international programs and guidance, many cities are finding it challenging to pursue adaptation in a coordinated and comprehensive fashion. While most are eager to learn from multiple sources, they often encounter normative models and advocacy rather than balanced information and ideas about adaptation that they can tailor to their cities.

This report draws on a series of focused discussions held by “adaptation leaders” from cities around the world, many of which are at the forefront in adapting to climate change. The discussions were organized around key themes – including what it takes to advance adaptation and achieve resilience, particularly with respect to enabling conditions, the position of scientific information in explaining impacts and vulnerability, approaches to adaptation planning and implementation, the role of partnerships and participation, and challenges in obtaining and managing resources for adaptation – but were also structured in such a way that new ideas and priorities could be raised by participants based on their own experience and insights.

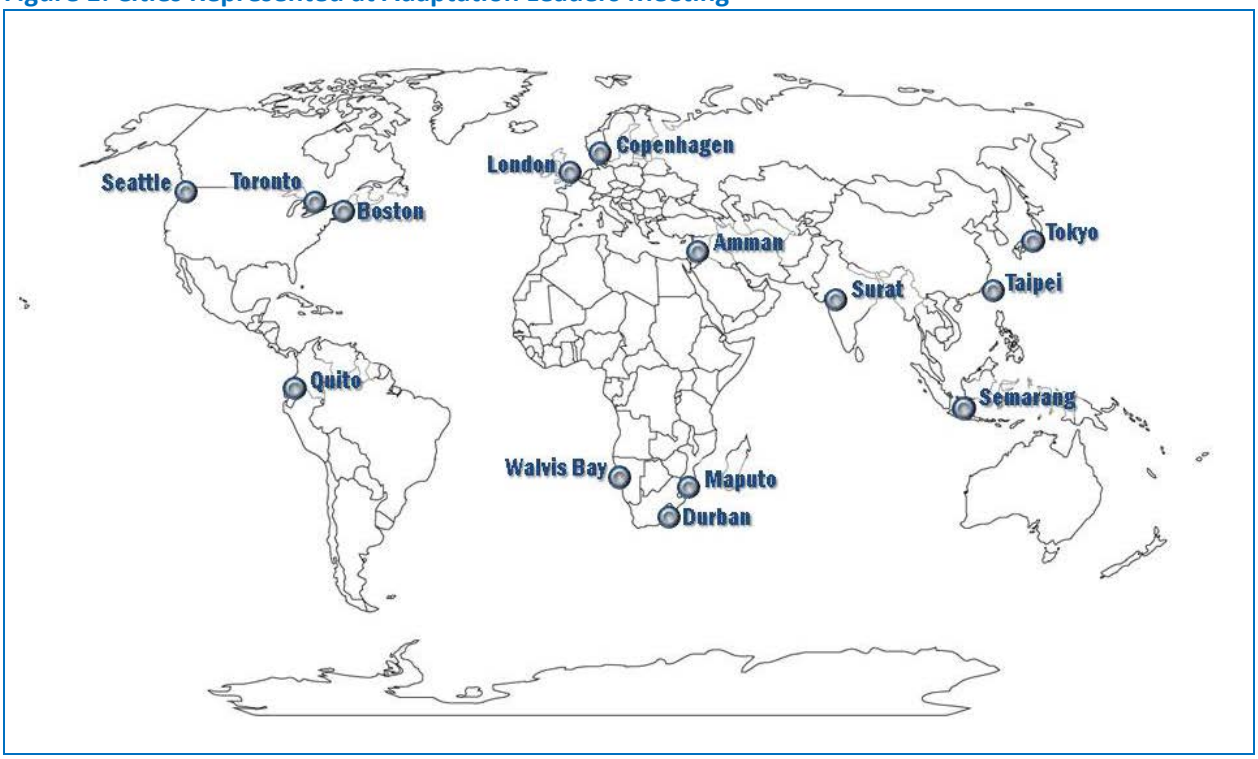
Research Approach

In recent years there have been a growing number of conferences and workshops exploring adaptation to climate change in urban areas. To date, these have tended either to focus on the presentation of positive case studies or the delivery of ”summit-level” commitments by senior elected officials. The specific knowledge, experiences, and needs of urban adaptation leaders who deal with these challenges on a daily basis have seldom been privileged or critically explored. As a result, those urban climate adaptation leaders have had few, if any, opportunities to candidly share their experiences, insights, and dilemmas with each other.

To provide urban adaptation leaders from around the world with an opportunity to reflect on their experiences, test their ideas, and learn from each other, a three-day meeting was convened at the Rockefeller Foundation Bellagio Study and Conference Center in April 2011. Fourteen cities were represented (Figure 1), twelve by members of staff from the municipal authority, one by a government-sponsored research institute, and one by a representative from a private firm that was instrumental to the city’s initiative (see Appendix 1). The participants were identified and invited through a purposive

sampling approach, based on the meeting organizers' detailed knowledge and experience of cities and individuals who have been actively engaged in urban adaptation. The meeting consisted of group and breakout sessions that explored a number of policy-relevant issues. The discussions addressed what motivated adaptation planning and how it was formalized, the ways in which cities use scientific projections and deal with scientific uncertainty, what types of assessments are being conducted, and the approaches being employed to engage different stakeholders, including the public, in planning and implementation. The sessions were facilitated by individuals familiar with urban adaptation planning in order to promote inclusion and recorded to ensure an accurate record of what was discussed. The recordings were then transcribed and the transcripts analyzed for themes in the discussions.

Figure 1: Cities Represented at Adaptation Leaders Meeting



This approach generated important new empirical information, as well as policy-relevant insights. Of course, since the discussions were based on the perspectives of a small group of individuals, and involved only a single person from each city, the voices and views reported here are limited. However, the setting and approach to facilitation employed at this meeting resulted in rich and detailed discussions about the challenges, opportunities, and prospects for adaptation to climate change in towns and cities.

Until recently, there have been few publications about urban adaptation to climate change, with most of these early papers focusing on articulating the problem or making calls for policy action or highlighting the need for empirical research. As recognition of the importance urban adaptation has grown over the years, so too has the body of published work. In 2011 alone, one dedicated manuscript (Pelling, 2011), two special issues of journals (Hallegatte and Corfee-Morlot, 2011; Romero-Lankao and Dodman, 2011), and two major policy reports (Rosenzweig *et al.,* 2011; UN Habitat, 2011) were published. In addition to numerous journal articles and books (including Bicknell *et al*, 2009; OECD, 2010), some of the notable contributions from 2012 were the launch of *Urban Climate*, an interdisciplinary journal dedicated to research on issues related to urban climate change, at least one new edited volume (e.g., Holt, 2012), and

several new policy reports (e.g., Carmin et al., 2012a**;** EEA, 2012; ACCCRN, 2012; Verner, 2012). Although we have gained many insights from these and other works, there is still much to be learned from adaptation activities taking place in cities around the world. Therefore, this report draws on the experience and insights of those leading adaptation initiatives in order to deepen our understanding of urban adaptation practice.

SECTION II: INITIATING AND SUSTAINING URBAN ADAPATION

Many city governments around the world are noticing new patterns of precipitation, temperature, and natural hazards that they are attributing to climate change (Carmin *et al*., 2012). These changes can affect a wide array of urban conditions such as natural resources, infrastructure, the provision of municipal services, and the quality of life for local residents, particularly those who are most vulnerable (Grimm *et al.*, 2000; Bai *et al.*, 2010; Satterthwaite, 2011). While mitigating greenhouse gas emissions and promoting sustainable development continue to be identified as priorities, in recognition of the current and future challenges they face, many city governments have begun to explore how the can best prepare for climate impacts (Carmin et al., 2012a; Romero-Lankao and Dodman, 2011).

Adaptation to climate change refers to adjustments to current or predicted changes in order to reduce vulnerability (Nelson et al., 2007; Chevallier, 2010). In particular, adaptation embraces both the decision-making process and the set of actions undertaken to reduce risk (Füssel, 2007; Nelson *et al*., 2007; Parry *et al*., 2007). Despite the imperative to take action, adaptation is still a nascent policy arena, with few generally agreed upon protocols and techniques (Carmin *et al*., 2012b). While more and more cities are aware of the need to adapt, those who begin exploring the process and options for adaptation and attempt to lead the charge frequently find that their concerns are sidelined in favor of other pressing issues, particularly economic and development considerations (Simon, 2012; Chuku, 2010). As a result, those championing adaptation in their cities often face fundamental challenges in generating interest and gaining commitment (Carmin *et al.*, 2012a). The sections that follow summarize the motivations that led the cities represented to take action and they types of support they regard as important to initiating and sustaining adaptation.

Motivations for Initiating Adaptation

Four main motivations were identified as drivers that led to the initiation of adaptation activities. First, the experience of a natural disaster (often floods) frequently led to a perception that natural hazards are occurring with greater frequency and intensity, and that cities are at greater risk of damage from these. This was the case in Copenhagen where adaptation was initiated after experiencing widespread flooding in low-lying areas in 2010 (April 20 AM Session 1: 2-3); while floods, along with droughts and recognition of the threat of sea level rise, also were also motivating factors in Semarang and Walvis Bay (April 20 AM Session 1: 30-31; April 20 AM Session 2: 16).

Second, concern about reduced availability of natural resources, particularly water, was mentioned by a number of cities as a driver for adaptation. For instance, starting in the late 1990s, individuals working at Seattle's water utility began to realize how their work and the city's resources would be affected by climate change. That, in turn, led them to engage the research community so that they could base their plans on scientific projections (April 20 AM Session 1: 10). Amman also has been concerned about water resources. The city, which lies in an arid ecosystem, has been experiencing changing rainfall patterns and reducing annual rainfall totals (April 20 AM Session 2: 1). Scarcity has led the city to pursue short-term measures, such as rationing, along with the piloting of adaptation projects that include household water storage technologies, gray water reuse programs, and urban agriculture schemes (April 20 AM Session 2: 1-3). In 2006, Amman's city administration invested and installed 10,000 rooftop gardens across the city in an effort to keep drinking water from being diverted for non-drinking purposes. These rooftop gardens not only provided additional income for these households from growing and selling herbal and medicinal

plants, the use of rainwater for this purpose also helped to conserve drinking water (April 20 AM Session 2: 1-2).

Third, adaptation programs can be sparked by a city's desire to demonstrate leadership in this arena. This was the case, for instance, in Tokyo when the city was hosting an international meeting focusing on adaptation (April 20 PM Session 1: 2-3). It also was the case in Quito where the mayor wanted to show that he was taking initiative in advance of a scheduled summit:

> And now Quito wants to lead nationally and internationally in terms of climate change local responses. So we are organizing Quito's climate change pact. That's going to happen in June and we're going to have all the mayors of Ecuador, which are 225, come to Quito to take measures and responses to face climate change. The important thing there is, because of that, the mayor wants to be able to show what he does in terms of adaptation and mitigation" (April 20 AM Session 1: 19).

Fourth, international programs on adaptation, sponsored or initiated by a range of international organizations and funders, have become a driving force for adaptation in many cities. Organizations and networks such as ICLEI-Local Governments for Sustainability, UN-Habitat's Cities and Climate Change Initiative (CCCI), the World Bank, Asian Development Bank, and the Rockefeller Foundation's Asian Cities Climate Change Resilience Network (ACCCRN) are promoting urban adaptation initiatives in a number of cities around the world (Anguelovski and Carmin, 2011). These organizations channel information and financial resources that enable cities to conduct risk and vulnerability assessments, pursue specific adaptation projects, and enhance their capacity to pursue adaptation. Three of the cities represented at the meeting indicated this as a driver. In the case of Maputo, climate change adaptation first gained traction when the city was selected to participate in the CCCI (April 20 AM Session 2: 21). The Initiative supported Maputo's work in raising awareness, building capacity, improving governance, and developing decision-support tools for decision makers to address the impacts of climate change (UN-HABITAT, 2012). After being identified by a national assessment as the most at-risk coastal city in Namibia, Walvis Bay formed partnerships with both ICLEI and UN-HABITAT that specifically targeted building capacity for adaptation planning (April 20 AM Session 2: 14). The international groups provided expertise that helped the city identify and coordinate stakeholders to form its Environmental Management Advisory Forum, which was responsible for integrating climate change adaptation into existing urban policies and plans (April 20 AM Session 2: 14-15). In Surat, ACCCRN was instrumental in helping the city engage both civil society and local government actors to delineate how different sectors can develop locally appropriate adaptation strategies and pilot resilience-building projects that address climate change adaptation, poverty reduction, and urban vulnerability (April 20 PM Session 2: 43-45; ACCCRN, 2009).
Fourth, some cities and local authorities are required to respond to national mandates to initiate adaptation. Of the cities represented at the meeting, this was the case for London only (UK Government, 2010) – however, as an increasing number of countries develop National Adaptation Plans and support mainstreaming of climate adaptation into planning process, this driver is likely to become more significant in the future.

Advancing Adaptation through Local Leadership

There was general agreement among workshop participants that strong leadership from city policy-makers and elected officials is required for advancing urban adaptation. Mayoral leadership can be very influential since it sends a clear message to city employees about the importance of adaptation. A specific example from Boston clearly illustrates this point. In 2006, the Union of Concerned Scientists prepared a

report on climate impacts, with the Mayor and staff members from city departments invited to a briefing event associated with the report. Although the expectation was that the Mayor would attend only briefly, he stayed for the entire presentation. As described by a participant at that meeting:

> Without anything needing to be said, his [the Mayor's] presence in that room for an hour sent a very strong message throughout the city of Boston and to all of the departments about the importance of dealing with the effects of climate change (April 20 AM Session 1: 24).

By the same token, political cycles can affect the development of adaptation programs in cities where efforts are underway. The election of a mayor in a large North American city in 2010, for instance, was based on a platform of cost savings. This was in contrast with the leading climate and environmental priorities of the incumbent. As a result of the shift in leadership, the level of priority on climate mitigation and adaptation changed significantly (April 20 AM Session 2: 9-10). While new administrations often are accompanied by new mandates, some elected officials continue existing climate initiatives while others revisit the approaches pursued by their predecessors. For instance, climate initiatives lost momentum in Quito following the election of Mayor Augusto Barrera in 2009, but the situation changed over the course of the following year when the city became involved in preparations for the Mexico City Climate Change Pact. Engagement in the Pact helped bring adaptation back on the agenda as the mayor wanted to be in a position to demonstrate what the city had accomplished (April 20 AM Session 1: 19).

The leadership provided by elected officials can be a significant contribution to a supportive environment for departmental action, one that empowers and encourages staff members to take initiative in developing innovative solutions to problems. In some instances, assuming a leadership role within the context of departmental work is voluntary or self-initiated. In Boston, for instance, the Executive Director of the Air Pollution Control Commission took the lead on climate change responses within the city, with the support of his supervisor and the Mayor, when he started in his position and the need for coordination became apparent. Similarly, with the support of former Mayor Greg Nickels and the city council, Seattle Public Utilities took the lead and provided the foundation for the city's adaptation planning initiatives (April 20 AM Session 1: 11).

In several of the cities represented at the meeting, adaptation was initiated and spurred forward by a departmental champion. Although these champions often are able to generate interest and promote some forms of action, they noted that only when elected officials and senior management support adaptation initiatives does it become feasible for concerted and coordinated action to take place. While upper level support is imperative, the participants further suggested that it would be beneficial to designate a representative from each department to be the point person for adaptation (April 20 PM Session 3: 17; April 22 AM Session: 11-12). This approach would ensure responsiveness to political mandates, foster coordination within and across departments, promote programmatic stability, and lead to more accelerated advancement of adaptation within the city.

National Commitment to Adaptation

The support of national governments is increasingly recognized in the literature as a key factor that contributes to the success of local adaptation initiatives (Amundsen *et al.*, 2010; Lu, 2011; Betsill and Bulkeley, 2006; OECD, 2010). While most participants reiterated the importance of policies, resources, and other expressions of commitment from national representatives, they also commented that they receive very limited legislative, technical, and financial support from their federal governments. For

instance, the availability of financial resources is critical to making investments that will advance adaptation. In some countries, city officials do not have authority to raise revenue independently of the national government while those that have this authority typically still rely on federal support for major initiatives. However, this absence of support may have had the positive impact of encouraging cities to integrate adaptation activities into their ongoing programs of work. Financial support from national government that is dedicated to urban action on adaptation is nonexistent in most cities, and where present is frequently delayed (April 22 AM Session 3: 4-5):

> Another particular challenge for us is in the five year program where, after two-and-a-half years, we get approval and the money comes wandering on down. It comes through national government, and national government in itself tends to be inefficient. And, again, there's a long time lag in getting that money from the national system to the local government level. So the time for effective action in cities is highly reduced (April 22 AM Session 3: 4).

Financial support from national government is critical, but so too is support in terms of commitments and regulations. The question about what role governments will play and what types of support they could and would provide was raised by participants in the context of discussions about developing and implementing adaptation plans:

> The question here is what is the role of the central government at that point? Do they help the local governments in drawing their plans, for example, or in building their capacity? Or do they just allocate the money, but then nobody is able to use it? (April 22 AM Session 2: 24).

One response participants had to this question is the need for national government to demonstrate that they have a commitment to local adaptation. As one participant noted, "…if you have open leadership in front, everything will happen" (April 22 AM Session 2: 23). In particular, participants suggested that commitment could be as simple as statements in support of adaptation, although a prevailing theme was that mandates, policies, and laws that promote action and coordination are important (April 20 AM Session 1: 10 and 20; April 21 AM Session 2: 7; April 22 PM Session 1: 6). Despite the importance of national government developing mandates that will enable local governments to make significant inroads in adaptation planning and implementation, as one participant noted, many are not prepared to take this step:

> The idea of any kind of mandate change for local government, [national government is] not even prepared to consider it. So, that's a real issue… because we're backing up against national law and policy, which we can do nothing about to change, so it's really inhibiting our actions (April 22 PM Session 1: 6-7).

As this comment suggests, demonstrated interest and commitment to adaptation by national level officials serves an important function since it can help to promote and sustain local action in a timely fashion. Appropriate national policies can help to facilitate or incentivize adaptation, and can also provide substantial support to local action – for example by funding research that provides spatially-relevant, timely and robust climate change information (OECD 2010).

SECTION III: CLIMATE SCIENCE, UNCERTAINTY, AND URBAN ACTION

Many urban policymakers and practitioners around the world have chosen to review existing data or commission projections of future climatic conditions since this provides them with a basis for identifying adaptation priorities and selecting adaptation activities (Hay and Mimura, 2006; Romero-Lankao and Qin, 2011). A variety of conceptual frameworks have been proposed for understanding climate change and the associated impacts in urban areas. However, two main approaches characterize the types of assessments conducted: those that focus initially on physical impacts (frequently referred to as the hazard approach) and those that focus initially on the social elements that shape the way impacts are experienced (frequently referred to as the vulnerability approach).

The hazard-based approach focuses on the incremental impacts of climate change and often starts with modeling climate change projections (Füssel, 2007). Many urban practitioners, particularly those in high-income countries where funds are available to support this type of activity, view the hazard approach as the most suitable, since it is expected to provide solid information about future climatic regimes and how these will affect the urban area (e.g., Mehrotra *et al.*, 2009; ICLEI/CSES, 2007; World Bank, 2010; UN-Habitat, n. d.; Hallegatte et al., 2011). However, the extent of future greenhouse gas emissions, the way in which the climate system will respond to these at a global scale, and the local implications of this at the geographical scale of individual cities are all uncertain (Mastrandrea *et al.,* 2010; van Vuuren *et al.,* 2011).

The vulnerability-based approach has a strong focus on the social factors that determine the sensitivity and coping capacity of urban systems and societies. It draws strongly on social theory and hazard studies (Miller *et al.,* 2010), and tends to result in a practical focus on assessing existing social and economic conditions and extrapolating how future shocks and stresses as a result of climate change will negatively affect these conditions. This approach has tended to dominate in low- (and some middle-) income countries, where poverty and informality have often been a major factor shaping the effects of environmental hazards on people's lives and livelihoods. To an extent, this approach informs thinking on urban resilience, which argues that future climatic conditions are too uncertain to warrant interventions that are tied to particular climatic regimes, and that responding to climate change requires strengthening existing systems, agents and institutions to manage a range of uncertain conditions (Tyler and Moench, 2012; da Silva *et al.*, 2012).

While each emphasizes different attributes, both types of assessments recognize that there are physical and social elements that contribute to how climate impacts and outcomes are experienced. Further, there is widespread awareness that basing assessments on climate projections, particularly those that are specific to a given city, contain high levels of uncertainty that limit their utility and applicability (April 20 PM Session 2: 7; April 21 PM Session 1: 26). Cities appear to be placing a growing emphasis on risk assessments. However, given the constraints with assessments in general, many urban assessments draw on elements of the vulnerability approach. In addition, there are some efforts to promote analyses that extend beyond both of these approaches, with the intent that true adaptation will only arise when structural transformations, such as those related to reshaping the relationships between citizens, governance institutions, markets, and the environment, can promote long term resilience in the face of uncertainty about climate change and development (Pelling, 2011). The sections that follow examine how the urban adaptation practitioners gathered at the meeting work with scientific projections, cope with uncertainty, and move from knowledge about possible futures to adaptation action.

Scientific Projections and Adaptation Planning

As has been the case for most cities around the world (discussed above), most of the cities represented at the meeting conducted or intended to conduct a formal assessment of climate change impacts. The majority emphasized risk assessments, although several combined risk and vulnerability-based approaches. Boston and Quito stood apart in their approaches. Rather than initiating the process with a formal assessment, they relied on existing regional data and analyses (which may then have been modified to respond to particular priorities), along with a number of focused sector-based assessments, to guide their planning. No matter what approach they took to assessments, most of the cities regarded climate projections as an integral foundation for adaptation planning. As noted by one participant:

> I do think the engagement in science is really important, and I think it can really set the parameters, and constrain the policy and managerial options going forward. So I think it's really important to have that engagement and understanding of the science, particularly as it's applied at a local level (April 22 PM Session 1: 11).

Cities – particularly in the relatively data-rich settings of high-income countries – often work with regional projections, developed by national and regional bodies. For instance, in the United States, the National Oceanic and Atmospheric Administration (NOAA) maintains regional research centers that help develop regional projections and sponsors the Regional Integrated Scientific Assessment (RISA) program or the UK Climate Impacts Programme (UKCIP). These initiatives allow municipalities in the same region being able to access and work from the same basic data. More specific information is available in some locations. For example, an assessment coordinated by the Union of Concerned Scientists provided information on climate impacts for both the Northeast United States and the Greater Boston region that, in turn, was used by the City of Boston to identify more specific risks and vulnerabilities. These regional initiatives have enabled cities to access relevant data. There are tradeoffs in using regional data: on the one hand, they are readily available; on the other, they are not downscaled to the city level.

As well as providing information that can guide policy and investment decisions, climate projections sometimes engender political support for adaptation. As previously noted, the Union of Concerned Scientists report, which also included sophisticated media outreach and an information campaign to raise awareness about climate change, acted as an important catalyst for action, drawing the attention of Boston's Mayor and thus resulting in political support for adaptation responses. Similarly, flood risk maps used by Copenhagen helped politicians visualize the locations where threats exist and generated commitment to pursuing adaptation. As one participant noted:

> A driver is also that we can show the politicians those risk maps. When we show them the risk map, they always [ask], "Okay, where do I live?" And they can see, "Oh, I live here." Maybe you could have them do something about this. It's a very good tool to show them what it has meant to the city because many—they don't know—many politicians don't know about this (April 20 AM Session 1: 6).

As these two examples illustrate, 'fine-grained' data to support precise decision-making were not essential for generating political commitment to adaptation.

Coping with Uncertainty

All regional projections, as well as downscaled models, have inherent uncertainties. The lack of certainty was summarized by a participant who commented, "we're doing it all with the recognition that the

climate science information we have isn't perfect" (April 20 pm Session 1: 20). Planning-related disciplines such as engineering may find it particularly challenging to deal with lack of detail or certainty in projections:

> There's a legacy of engineers and others being trained to design to fixed points, rather than the uncertainty. So we've got that legacy that we need to overcome almost, and start training in different ways so that people build in flexibility to their decisions, and that's where the cross-sector work comes in, because to build in that flexibility, it won't necessarily be just met by your discipline (April 22 PM Session 1: 24).

Infrastructure requires large investments and often is rooted in traditional approaches to planning. While this can contribute significantly to reducing exposure to particular kinds of hazards, the relatively high cost and inflexibility of this approach may mean it is inappropriate for responding to climate risks. In Durban, for instance, although engineers have amended specifications for new infrastructure based on projections of a 15 percent increase in storm water runoff, this projection is valid only for a relatively short proportion of the overall intended lifespan of the infrastructure (which ranges from 20 to 50 years). Many cities are beginning to recognize the limits of traditional engineering and are exploring how they can pursue more flexible strategies. In addition to building larger pipes to deal with increased runoff, they are planning for uncertainty through innovative measures, such as ecosystem-based measures which can adjust gradually to changing conditions while generating co-benefits, such as reducing urban heat island and providing recreational spaces.

> In terms of dealing with the kind of pressures cities are going to be under, you're probably looking for a more holistic package of interventions rather than interventions linked to a particular scientifically defined impact (April 20 PM Session 2: 7).

Yet despite the widespread use of scientific assessments as a foundation for the adaptation planning process, some of the participants have begun to question whether this is the best starting point for adaptation:

> It seems that we all start with some kind of impact assessment regardless of how bedeviled the science is. We seem to want the comfort of science. I must admit to [that] having gone through our process. I'm beginning to wonder whether that's always the best place to start, whether we don't spend too much time and resources fiddling with uncertain science, if there's not a better way to come at the problem than that. Maybe we ought to just think about that (April 20 pm Session 1: 7).

In contrast, the participants had begun to consider the ways in which no-regrets measures could be applied without detailed downscaling of climate models, and in which measures to reduce risk from climate change could simultaneously address development deficits and reduce disaster risk. This is in keeping with the conclusion from the IPCC Special Report on Extreme Events that "the most effective adaptation and disaster risk reduction actions are those that offer development benefits in the relatively near term, as well as reductions in vulnerability over the longer-term" (O'Brien *et al.* 2012, p439).

From Assessments to Adaptation Measures

The main issues addressed by climate scientists are projected changes in precipitation, temperature, storms, and sea level. Cities not only need to understand what type of risks they face, but how these contribute to and compound vulnerabilities. Vulnerable population groups frequently are identified

through assessments. For example, Toronto Public Health has conducted extensive research on factors that contribute to the vulnerability of residents to heat and what can be done to reduce the risk of heat related illness, especially for vulnerable residents living in high-rise public housing:

> There is a significant concern with populations in high-rise buildings that have no air conditioning. Often there may be limited ventilation because of a lack of cross ventilation, but also the windows may not open wide due to security or child safety reasons. Elderly and health-compromised people are often the most vulnerable. Persons of limited financial means may just have no other place to go to get cool. For this reason, Toronto Public Health operates a Heat Alert Program that includes notification of the public, but also redeployment of staff to seek out vulnerable persons to assist them with the heat situation. Toronto Public Health is conducting policy analysis on possible requirements for maximum temperatures inside rental buildings. There is also consideration being given to the possibility of requiring a common "cool room" where tenants can go to get a break from the heat of their own dwelling units (April 21 AM Session 1: 29-30).

Apart from expanding cooling centers, programs were developed for retrofitting and renewing these public housing towers. Toronto has a "Better Building Partnership," which provides a rotating loan that gets paid back through the savings in energy. There is also a Tower Renewal Program that has been developed to develop funding mechanisms and technically preferred approaches to increasing energy efficiency, replacing single pane windows, and replacing old plumbing and electrical fixtures. The highest level of retrofit being examined is putting a cladding on the exteriors of the buildings, improving insulation in apartment units, remodeling balconies so they conserve heat during the winter and are insulated from outside heat during the summer (April 21 AM Session 1: 30).

Many cities are increasingly engaged with the practice of climate change risk assessment as a specific component of adaptation measures. Toronto in particular has developed an advanced climate change risk assessment process and tool. This climate change risk assessment has been implemented in its Social Support and Housing Administration, as well as within Toronto Transportation Services (roads department). At the time this work was done, it was believed to be one of most in depth analysis of a roads department to climate change ever undertaken. The rationale for this level of effort is primarily on the basis of the replacement value of the road infrastructure in Toronto being CAD$12.1 billion – as the roads department has a budget of approximately CAD$800 million, even relatively small damage to the infrastructure due to extreme weather be considered financially important (April 20 AM Session 2: 11).

Toronto's risk assessment tool does not only assess economic costs, but it also considers social, environmental, reputational, legal, operational, and logistical impacts. Examples of issues considered include overheating and freeze/ thaw deformation of pavement surfaces, damages to bridges and culverts, malfunctioning of traffic signal controllers, wind damages to signs. In the work, a very significant factor was the implications of workers' ability to cope with extreme weather events and the balance being struck over cost savings and customer service. Overall, the purpose of the work is to guide infrastructure design, construction, operation and maintenance decisions in the short, medium and long term. Notably, Toronto staff developed the risk assessment tool with the idea that the tool could one day be useful in other jurisdictions. Toronto City Council granted permission to staff to license the tool to other municipalities or companies. Municipalities in Ontario can receive the tool upon request. Other cities and companies are requested to discuss financial compensation (or a trade of in-kind consideration) to help recover some of the development costs of the tool.

In general, the participants highlighted that data and Information about future changes in climate are critical foundations for their adaptation programs. However, because precise downscaled projections are difficult, expensive, or impossible to implement, cities must take action under conditions of uncertainty. As a result, they must work with the information that is available and also to acknowledge the presence of uncertainty as they move forward with their planning and implementation.

SECTION IV: ADAPTATION PLANNING AND IMPLEMENTATION

Guidebooks and programs for adaptation planning typically map out highly structured, linear processes for cities to follow. Some of the best known are sponsored by international organizations with the intent of building local capacity and supporting adaptation initiatives. Among the manuals currently available are the World Bank's *Guide to Climate Change Adaptation in Cities* (2011), UN-HABITAT's *Planning for Climate Change* (2011) and *Developing Local Climate Change Plans* (2012), and ICLEI-Local Government for Sustainability's *Climate Adaptation Guidebook* (2007). Common to these guides are a focus on the need for assessing citywide impacts and vulnerabilities, identifying key sector- and impact-based adaptation strategies, and the value of participatory mechanisms for developing plans and for monitoring and evaluating outcomes. A similar reliance on programmatic approaches based on classic planning and decision models has emerged in the scholarly literature as well. For instance, Füssel and Klein (2004) suggest that prerequisites to adaptation planning include the awareness of the problem, availability of adaptation measures, information about these measures, availability of resources for implementing these measures, cultural acceptability of these measures, and incentives for implementing these measures (Füssel and Klein, 2004). Similarly, Measham *et al.* (2011) suggest that successful adaptation planning is based on traditional planning tools such as strategic, goal-oriented planning, and land use planning (Selman, 1996; Measham *et al.*, 2011). In all of these approaches, the emphasis is on obtaining the best possible climate data and using projections as a basis for taking action.

The discussions among participants alluded to the limits of these normative models for adaptation planning and implementation being advanced, as they typically do not account for the local governments' need to balancing social, economic, and political dynamics. As elaborated in the sections that follow, the city representatives find that they can employ "rational" approaches in some arenas, such as setting priorities based on climate projections, but that they also need to attend to "practical" issues, such as accounting for political pressures and local priorities. Established models of urban planning also seek to incorporate these issues and have the potential to contribute significantly to adaptation planning – however, this potential has yet to be realized in most cases (Hurlimann and March, 2012). Further, in order to balance rational and practical considerations, cities are finding that they often need to blend "comprehensive" and "sectoral" planning.

Rational Planning versus Practical Considerations

In keeping with normative models and recommendations, many of the participants at the meeting noted that they account for scientific projections in their adaptation planning. However, they further noted that political dynamics play a central role in shaping the ways in which planning and implementation unfold. As one representative noted, "During the implementation phase, it's turning to be about 90 percent institutional politics" (April 21 PM Session: 4) and then later commenting that, "politics overrides engineering and science" (April 21 PM Session: 11). As another participant noted:

> I think, potentially, institutional politics overturn the importance of science… very often we're finding that your arguments about risk really depend on the type of institutions and politics you have in place… So you can have the best tools in the world. Unless you have a political setup that has the mindset that's really good and institutions that are capable of dealing with it, that becomes problematic (April 20 PM Session 2: 8).

Tensions between rational planning and practical considerations have arisen multiple times in one city where political ambitions and goals threaten to derail the city's ecosystem-based adaptation agenda. For example, in one instance, city authorities overrode engineering recommendations to not build new infrastructure and buildings in coastal zones prone to flooding and sea level rise. In order to proceed, the new coastal infrastructure had to have extra reinforcements that led to notable additional expenditures that some viewed as "wasteful" (April 21 PM Session 1: 12). In another city, tensions emerged when the city authority identified a need to move 500 households out of risk-prone areas. This issue of relocation and migration was coupled with conflicts over natural resource management and access (April 21 AM Session 1: 7).

Given the presence of political constraints and dynamics, adaptation planning often requires balancing rational and practical approaches. In some instances, this means seizing opportunities that present themselves, sometimes unexpectedly. For example, after the recent elections in one city, the new mayor has not placed climate change high on the agenda (April 20 AM Session 2: 10). Although the results were not discussed, in response, some leaders in the city have attempted to rearticulate adaptation priorities in terms of legal "due-diligence," which refers to the "possibility of liability of elected officials and senior executives if they knew, or reasonably should have known, that there was a problem and didn't act" (April 20 AM Session 2: 10).

In other cases, taking a practical approach means recognizing resource and commitment limitations and linking adaptation to existing initiatives, such as environmental management strategies and urban development projects.

> We all seem to link our adaptation interventions to existing initiatives. So we cobbled onto stuff that we're already doing… the easy way to sell it is to link your cart to a horse that's already heading in the right direction. And also picking up on the no regrets options. So we're not doing anything really bold that's changing our systems. We're kind of sticking to what we know, and that again worries me, because I think in some of our cities, some of the interventions do need to be bold and big and out there and the question is, are we able to do that (April 20 PM Session 1: 7)?

Taking advantage of existing processes can promote mainstreaming, and can enable departments to coordinate, consolidate, and move forward in their work (April 20 AM Session 1: 19). However, as the participants suggest, this may come at the cost of generating widespread understanding of the need for adaptation and achieving systemic transformation.

Plans versus Mainstreaming

When developing an adaptation program, cities need to account for projected climate impacts and attend to local politics, political agendas, goals, institutional structures, and resource constraints. Accordingly, cities need to advance adaptation programs in ways that are practical and respective of the local political, social, and economic context.

Table 1: Participant Approaches to Planning, as of Spring 2011

	Type of Citywide Assessment		Type of Adaptation Plan			Approach to Integration	
	Hazard Assessment	Vulnerability Assessment	Include Adaptation in Climate Action Plan	Create Strategic Adaptation Plan	Develop Dedicated Sector Plan(s)	Mainstream into Policies or Sectors	Incorporate into Sector Plan(s)
Amman	Intended	Intended	Intended			Intended	
Boston			✓			✓	
Copenhagen	✓	✓	✓	✓	Intended	Intended	Intended
Durban	✓			✓	✓		✓
London	✓	✓		✓			
Maputo	✓						
Quito	Intended	Intended	✓	Intended	Intended	✓	Intended
Seattle	✓	✓	✓			✓	✓
Semarang	✓	Intended	Intended	✓		Intended	
Surat	✓	✓	✓	✓	✓	✓	Intended
Taipei	Intended						
Tokyo	✓						Intended
Toronto	✓	✓	✓	✓	Intended		✓
Walvis Bay	✓			Intended		✓	

As Table 1 summarizes, the cities represented at the meeting adopted approaches to assessments and adaptation plans and planning that were locally appropriate and relevant. All of the cities are drawing on climate projections. Most cities, such as Boston, are conducting dedicated assessments using regional projections as a baseline for understanding changes that will take place locally and then developing more detailed analyses on a sector-by-sector basis. Mainstreaming into policies or sectors refers to departmental efforts to integrate adaptation into ongoing work and programs. In contrast, incorporating into sector plans refers to initiatives to integrate adaptation into one or more sector plans, often in the context of creating a new or updated sector plan.

Cities including Toronto, London, and Copenhagen, have developed dedicated approaches to adaptation planning and plan-making. As previously noted, sometimes this is a response to a stated mandate. For example, the Greater London Authority is required to publish climate change risks and produce a citywide climate change strategy (April 20 AM Session 2: 31). In other instances, such as Copenhagen, the city elected to develop a dedicated adaptation plan (April 20 AM Session 1: 3-4). An alternative to this approach is to develop sector plans. Durban started out with a general adaptation plan, but after some trial and error has been developing sector plans, starting with water, public health, and disaster management (April 21 PM Session 1: 4). Sector-based planning has the advantages of promoting integration:

> … it's smart to try to deeply embed and just make the adaptation part of the process, so that lots of city departments are just simply doing it part of their job, and so that could mean having operating procedures where you're just writing in, and you don't necessarily have the word adaptation; you just take into account extreme weather, for instance, and that that's the way that they have to do that every time someone does their particular function (April 22 AM Session 3: 9).

Many cities are focusing on mainstreaming adaptation. One variant of this approach is to integrate adaptation into citywide initiatives. This is the case in Walvis Bay where, after the completion of a vulnerability assessment, the Environmental Management Advisory Forum recommended that the city, in partnership with external experts, start building climate change adaptation into municipal policies, plans, and agendas (April 20 AM Session 1: 14). Another variant is to focus on integration into the work and activities of discrete departments. Tokyo, for instance anticipates that after completing a risk assessment, adaptation will be addressed by each department in the context of ongoing initiatives.

Since mainstreaming does not always distinguish adaptation as separate from ongoing operations, it may be less susceptible to changes in political agendas and leadership. Despite this advantage, without a dedicated plan, adaptation may be regarded by the public and community groups as diffuse and, therefore, not fully addressing the problem (April 21 PM Session: 20). Further, departments may focus on localized rather than systematic risks and may find that it is difficult to achieve coordination between them, and to ensure accountability for overall progress towards adaptation (April 21 PM Session: 20-22).

In reality, many cities adopt a hybrid approach. Those with adaptation strategies often also work to integrate adaptation into the work of individual departments, while those that develop sector plans or focus on mainstreaming also having an overarching, citywide strategy. This is the case in Boston where the city's climate action plan specifically addresses adaptation and efforts are also being made to embed adaptation into the day-to-day functions of departments. This type of integration is seen, for instance, in the Boston Water and Sewer Commission's attention to sea level rise and increased precipitation in its 25-year capital asset management plan for stormwater and wastewater (April 21 PM Session 1: 15). Similarly, adaptation is reflected in the Transportation Department's Complete Streets Program (April 21 PM Session 1: 17), the city's emergency operations plan (April 21 PM Session 1: 17), and the Environment Department efforts to protect coastal wetlands (April 21 PM Session 1: 18). The benefit of a hybrid approach is that:

> It puts adaptation in the context where the consequences, the solutions, and the priorities can be evaluated relative to all the needs of the community, at least that's defined by the agencies that have responsibility in which areas… At the same time, by embedding the task within those agencies, it helps to build their internal capacity to understand climate change information, even without [external] intervention or expertise…(April 21 PM Session 1: 19).

One challenge associated with mainstreaming is that the municipal adaptation agenda may become diffuse, and it may seem as if the city is not really addressing climate impacts substantively. Further, departments tend to address localized rather than systematic risk at the city scale and it is difficult to improve consistency and coordination between departments (April 21 PM Session: 20-22).

Selecting Adaptation Interventions

In the course of the discussions, several factors emerged as important in selecting adaptation interventions. The first of these is financial feasibility and constraints. Copenhagen, for instance, has dug deep reservoirs for storing rainwater. However, since they are very expensive to build and to maintain, the city is looking into other alternatives to manage rainwater and mitigate flooding. This highlights two interrelated factors: flexibility and learning. Rather than honing in on a single approach as the one right way, or focusing solely on large-scale technology, the leaders gathered at the meeting highlighted that they need to be flexible and to continually evaluate their own actions and learn from others. In the case

of Copenhagen, this flexibility is reflected in their view of rainwater as a resource that can either be channeled or reused. Rather than focus on building reservoirs for stormwater retention, which are very expensive, they are redirecting rainwater from draining into existing underground pipes and into newly built creeks that lead directly to the sea. This strategy allows the city to economically increase the amount of rainwater that can be transported out of the city to reduce the potential of flooding (April 20 AM Session 1: 3).

A second constraint identified by many participants is the need for adaptation interventions to simultaneously contribute to the advancement of other city goals and objectives, including those related to climate change mitigation**.** In Quito, for example, the multi-criteria analysis used for evaluating on adaptation projects also includes an assessment of the potential to address mitigation of greenhouse gas emissions (April 21 PM Session 2: 14). As a result, Quito's improved waste treatment facility not only contributes to urban greenhouse gas emissions reduction through a methane capture and recycling process, but also simultaneously improves urban sanitation (April 21 Session 2: 14). Similarly, Amman's Urban Sustainability Initiative actively seeks projects that link adaptation interventions with mitigation and development activities. Although identifying projects that contribute to multiple goals could be perceived as limiting, this approach helps the Urban Sustainability Initiative to work within resource and budget constraints.

Third, the measures to support cities' goals while attending to resource constraints often means that a suite of measures, rather than one large project, may be necessary. Furthermore, these measures may need to be phased in over a period of time.

> The things that I would have to say about adaptation as a process is that I don't think either it's one action or the other, but it's the whole social institutional process, which is dynamic. And maybe one year you're going to plant trees, and then maybe the next year, you're going to put in air conditioning systems. It's not just one action, and having to choose between actions (April 22 PM Session 1: 24).

As these discussions illustrate, adaptation can be advanced through mainstreaming, taking a flexible approach that incorporates new projections and responds to conditions as they change over time, and by drawing on a variety of measures, including those that balance structural and non-structural approaches to adaptation. While an emphasis often is placed on planning and implementation, with a focus on the use of engineering interventions, these comments further highlight that adaptation is also a political process that requires accounting for politics, political cycles, and addressing city goals and priorities.

SECTION V: PARTICIPATION AND PARTNERSHIPS IN URBAN ADAPTATION

Increased participation in all facets of urban management is associated with elements of good urban governance. Although participation and stakeholder partnerships can strengthen democracy, most local authorities emphasize the ways in which these measure enhance their capacity and generate higher levels of legitimacy and support for municipal actions (Harpham and Boateng, 1997). While this is a pragmatic approach that focuses on improved government performance, it also appears that many local governments recognize that participation can promote equity, build capacity, and promote a new generation of leaders (Cleaver, 2001; Pelling, 1998).

Given the impact and importance of these approaches, many urban practitioners see the potential for participation and partnerships in building and implementing urban adaptation programs (Aylett, 2010; Kithiia and Dowling, 2010; Rosenzweig and Solecki, 2010; Anguelovski and Carmin, 2011). Processes that involve local stakeholders can shape government decisions (Shackley and Deanwood, 2002) while promoting strategies and policies that are suited to local realities and experiences (van Aalst *et al.*, 2008). Engaging stakeholders in adaptation planning can be particularly challenging given the long-term and uncertain nature of the problem (Few *et al.*, 2007) and the fact that an understanding of the need for adaptation often is limited to policymakers and researchers (Lwasa, 2010). To bridge this gap and promote involvement, many cities target stakeholder groups through the formation of climate action committees, task forces, and knowledge brokers (Anguelovski and Carmin, 2011; Lu, 2011). According to Lu (2011), partnerships and collaboration among these diverse stakeholder groups are critical to the efficient and effective provision, delivery, and application of climate change information. While participation may be important overall, cities each need to identify approaches that are best suited to their needs.

This section discusses the ways in which urban adaptation leaders have incorporated processes of public participation in adaptation planning and implementation, and the approaches they have taken to cultivate partnerships to make adaptation more effective. More specifically, the discussion that follows elaborates on the ways in which local authorities have encouraged the participation of communities and civil society organizations, created expert committees and task forces, developed partnerships with universities, research organizations, the private sector, other cities, and international organizations, and summarizes the challenges they are encountering in promoting participation and partnerships.

Stakeholder Engagement and Public Participation

Several of the cities in the meeting have promoted participation by engaging community organizations, local residents, or local community leaders in the development of adaptation plans. The 'Shared Learning Dialogue' approach used by cities participating in the Asian Cities Climate Change Resilience Network (ACCCRN) involves key stakeholders and the public in the process of vulnerability analysis and the development of a resilience strategy that outlines adaptation priorities and specific categories of activities and projects. The involvement of a wide group of participants is intended to ensure that the plans and projects, "go beyond planning processes and creating documents, to actually trying different approaches to building resilience in cities and trying to understand what works and what doesn't, or what's cost-effective, what's equitable, and to learn" (April 21 PM Session: 30).

Among those gathered, Quito employed the widest range of participatory approaches. In the early stages of adaptation planning, participatory forums or dialogues were held with different stakeholders. This helped to define the main lines along which the Quito action plan was focused. Stakeholder groups, along with a team of consultants, then identified 53 projects that became part of the municipality's plan for the next three years. The city also used input from these groups to define the criteria for prioritizing the projects. This enabled them to create a final action plan that focused on 23 key projects from the original list. More recently, Quito has been actively seeking community leaders to engage on adaptation concerns. This strategy is informed by the desire to penetrate more deeply into neighborhoods, and to ensure representation of specific geographic communities and social groups. For example, the city approached youth leaders directly through school programs and then organized capacity building workshops in which these young leaders would teach their peers. Building on the belief that it is important to engage youth, they also sought out environmental groups that are staffed by young people from poor and marginalized neighborhoods who are highly motivated and who can "promote change in their families, in their schools, and universities" (April 21 AM Session 1: 6) and organized a national youth committee for climate change that will develop its own action plan. In addition, the city is exploring how civil society groups with relevant concerns, such as cycling, sustainable transportation, and water management, can contribute to the implementation of the Quito climate change strategy.

Some of the cities involved in the discussion have worked successfully with community-based and grassroots organizations. For instance, the Live Green Toronto program employed a group of "community animators" to promote community-based adaptation projects. Through community outreach, engagement, and consultation, these individuals solicited community development project proposals and then provided funding to projects that promote community development and social cohesion with an environmental focus. Most of the projects were oriented towards climate change mitigation, but several projects, such as green roods and tree planting, also had adaptation benefits. In London, the adaptation planning process was managed by the London Climate Change Partnership, which included a range of stakeholders including the UK Climate Impact Programme, the Association of British Insurers, representatives from universities, and politicians. The adaptation planning process went through two formal, three-month long consultation exercises, one with elected officials from across London and another that was open to the public, although this did not generate many comments from citizens (April 21 AM Session 1: 16). The planning process was also enhanced by a website that employed interactive features that allowed the public to vote for top ideas. Community flood planning in London further illustrates that adaptation programs have the potential to be implemented by those who are most affected. The city provides education and demonstrations to local residents so they can learn how to prepare themselves for flood events. This approach has encouraged and empowered residents to take ownership in this process of flood preparedness (April 21 AM Session 1: 17).

Several cities represented at the meeting encouraged participation in the implementation of adaptation projects. One mechanism to promote this was providing small-scale funding for particular projects such as the activities identified by local "animators" in Toronto and the ten projects selected by young environmental leaders in Quito. In both cases, small-scale funding was seen as a means for promoting public engagement, building capacity, and advancing adaptation. In Quito, the aim was to identify and build capacity in poor and inaccessible areas:

> … and we went there, and we started with capacity-building work and climate change adaptation and risk management. We work with young leaders, young environmental leaders… they are the ones that give the capacity-building workshops. It's not people

> from the municipality, but it's also young people. So it's capacity building from young people for young people (April 21 AM Session 1: 5-6).

Efforts to promote widespread participation in adaptation planning and implementation appear to have the potential to increase the effectiveness of these initiatives. While this is a pragmatic approach that focuses on improved government performance, it also appears that many local governments aim to promote equity, build capacity, and promote a new generation of leaders through these efforts.

Expert Committees and Task Forces

Another widely recommended and adopted technique for urban adaptation is the creation of expert committees and task forces. For example, the 'Working Group' approach encouraged by the UN-HABITAT Sustainable Cities Program highlights the need for these groups to deal specifically with complex crosscutting issues that are poorly served by traditional governance structures, and for them to include representation and participation from a wide range of public sector, private sector and civil society groups (UN HABITAT, 1998). This is also a mechanism for expanding the range of contributors and expertise to developing adaptation responses.

Two different advisory groups were formed in Boston. The first of these is a Community Advisory Group, with membership selected by nominations from neighborhood forums and community groups, and with the goal of having representation from every neighborhood in the city (April 20 AM Session 1: 24-26). The second group is a Leadership Committee, which was selected by city staff and the Mayor, and included academic scientists, leaders from the business community, advocacy groups, planners, and property owners (April 20 AM Session 1: 25). The leadership committee was highly structured and was divided into working groups that met over the course of the years 2009 and 2010 and gave their recommendation to the Mayor for the publishing of *Sparking Boston's Climate Revolution* (City of Boston, 2010).

Quito also has a scientific advisory group, known as the Quito Climate Change Panel, which is intended to provide the necessary information on which decisions can be based (April 21 AM Session 1: 9). The purpose of this panel is to ensure that research conducted by universities is relevant to and used by the municipality; in this way, it can also influence the ways in which projects are devised and executed (April 21 AM Session 1: 9-11).

Partnerships with Universities and Research Organizations

Scientific advisory groups can be formed through partnerships with universities and research organizations. Throughout the discussions, universities and research institutes were noted as critical partners for working on adaptation, particularly in the areas of data generation and capacity and institutional support – as is evident in Section III. One area in which this can be important is in the production of climate projections, scenarios, and other information. In Seattle, data from the University of Washington has been used to create GIS layers and to map potential inundation within the city, enabling examination of both the chronic aspect of sea level rise as well as episodic events such as storm surges. These partnerships do not need to be with single institutions: the production of climate scenarios by the UK Climate Impacts Programme, which is housed under the University of Oxford's Environmental Change Institute, helped to enable the process of adaptation planning in London: "the science base started [London] off in terms of understanding and then working with the environment agency… and that provided the rich contexts [for] the GLA [Greater London Authority] to do their work" (April 20 AM Session 2: 31).

Similarly, Boston's planning for climate change also is informed by the work of researchers from local universities and institutes. In 2004, a group of academics, in partnership with the U.S. Environmental Protection Agency, published a report called *Climate's Long-Term Impact on Metropolitan Boston*, which analyzed the economic effects of sea level rise, heat waves, and other projected climate impacts. In 2006, the Union of Concerned Scientists' report on climate impacts in New England also helped to facilitate discussions around the impacts of climate change on Boston's property values and the potential economic benefits of taking early preparatory action (April 20 AM Session 1: 23).

In addition to developing co-agendas or being consumers of research, there are other ways in which city-university partnerships can be fruitful. For example, the City of Toronto is working with the local watershed authority (Toronto and Region Conservation Authority) and universities to enhance local capability in climate science, from both the modeling and social science perspectives. There is also the potential for partnerships around building climate change-related graduate programs, to ensure a future workforce (for city authorities, as well as for the private and public sectors) with the necessary skills to engage with climate change issues. Conversely, the absence of suitable research partners with the ability to produce both valid and policy-relevant scientific information can create challenges for municipalities. This is the case in many African cities, including Walvis Bay.

Engaging the Private Sector

In many cities, mayors and city authorities work closely with private sector and business interests. Private contractors increasingly perform urban functions that are relevant to adaptation (including the provision of water and the management of solid waste), while city governments play an active role in attracting external investment by large corporations into urban infrastructure development projects and adaptation projects and programs, through both their own internal investments and through urban development projects (Agrawala *et al.*, 2011). In relation to adaptation, partnerships between municipal governments and the insurance and engineering industries have a role both on specific projects as well as on supporting the broader adaptation needs of urban economies. In general, discussions highlighted the need to garner support from the business community in order for adaptation projects to be successful and sustainable.

Insurance companies were identified as important municipal partners based on the strong understanding they have of emerging risks (April 22 AM Session 3: 12). However, practical efforts to engage the insurance industry have been met with a mixed response. Several years ago, Toronto engaged with the insurance industry to increase homeowner awareness about actions and a grant program to reduce the risk of basement flooding associated with extreme rain. The Canadian insurance industry has produced a "Municipal Risk Assessment Tool" risk assessment tool for urban flooding and various municipalities have worked with the insurance industry to develop detailed maps of properties at risk of flooding. Also in Toronto, the Insurance Bureau of Canada has provided direct in kind assistance in promoting a coalition of government and businesses interested in climate change adaptation known as the "WeatherWise Partnership." On the other hand, Copenhagen's councilors prevented the city from partnering with a particular company because this might be seen to imply favoritism. This was addressed with by engaging with the Association of Insurance Companies rather than with a single company.

Cities can also benefit from developing partnerships with the engineering profession. Engineers have the potential to assess the vulnerability of certain urban assets such as wastewater treatment plants, water treatment plants, roads, and associated structures and buildings. For more than six years, Engineers Canada has been working on developing engineering protocols for climate change engineering

vulnerability assessments that are relevant to public infrastructure. Natural Resources Canada funded a multi-year initiative through Engineers Canada's "Public Infrastructure Engineering Vulnerability Committee." This initiative involved dozens of pilot risk assessments and training programs for Engineers. Examples of engineering vulnerability assessments done in Toronto include two flood control dams, three major culverts, part of the Toronto electricity supply system and a high–rise public housing building.

Toronto and London have been active in recognizing the importance of outreach to critical infrastructure groups through the formation of the partnerships. The London Climate Change Partnership was formed around 10 years ago, and Toronto's WeatherWise Partnership was formed more recently. In this case, prior to setting up their WeatherWise Partnership, City of Toronto staff reached out and learned from the experiences of London and also New York City where there is a "Mayor's Task Force on Climate Change Adaptation." The essence of the London, Toronto, and New York groups is a multi-sectoral approach that recognizes the interdependencies amongst infrastructure groups. For example, most infrastructure relies upon electricity, and for continuity of electricity, there is a need for road access to maintain equipment. Roads departments in turn rely upon telecommunications equipment, which in turn relies upon electricity.

Throughout the discussions, there was a strong sense of the need for an active working relationship between city governments, infrastructure providers, and the private sector. City governments need to implement the necessary actions to reassure businesses that their investments are safe and secure, both in relation to climate change as well as a range of other shocks and stresses. Participants perceived that cities that can promote resilience are "better regarded to attract and retain employment". Conversely, business and economic interests need to understand risks in order to evaluate the ability of individual and corporate borrowers to repay loans and investments (April 22 AM Session 3: 13).

Interacting with Other Cities, Networks, and International Organizations

orking with international networks and organizations has been both a catalyst for pursuing adaptation, and a means for building capacity in some cities. As previously noted, Maputo, Walvis Bay and Surat received support for adaptation from international organizations. Further, many issues related to urban climate change must be addressed at the regional scale, particularly the water and transport sectors. Toronto noted that its surrounding areas affect the city, such as through the larger water catchment area and regional transportation networks. Accordingly, Toronto has worked with the regional conservation authority and has encouraged the formation of a regional collaborative of municipalities that meets on a regular basis to share information (April 20 PM Session 1: 4-5). In some instances, coordination to address climate impacts both within and across countries requires the creation of new regional governing bodies. For instance, faced with the retreat of glaciers that provide the majority of the city's water, Quito established a regional adaptation project that includes Peru, Bolivia and Ecuador (April 22 AM Session 2: 38).

To promote knowledge sharing and learning, cities have begun to cooperate with each other to develop networks. Copenhagen, London, and Rotterdam all pointed out that they have made efforts to engage and learn from their peers. In-person discussions at meetings, email correspondence, and over the Internet searches all provide important means for the obtaining information and generating ideas. Most practitioners recognize that they frequently need to modify the approaches employed elsewhere so that their own actions are contextually appropriate:

> So you will find, like, at least ten or 20 or sometimes 50 different project documents from different places in the world. Some of them, they have exactly the same condition you have… And so, that you don't have sometimes to reinvent the wheel. Because, in many cases, that you have the same condition, like the same situation, the same environmental problems. So you'll just, like, be able to at least draw, like, some lessons from these, or have some ideas that you can share it with others, and you can build on it (April 22 Am Session 2: 29).

Challenges of Participation and Partnerships

While there was an almost unequivocal recognition of the benefits of working with a range of stakeholders, the challenges associated with this were also widely recognized. Although all of the cities involved in the discussion acknowledged the benefits of incorporating participatory processes in both strategic planning and project implementation, they also recognized that adaptation practitioners must be cognizant of the proper timing and level of support, and must be careful not to raise unrealistic expectations, in order to create the most effective participatory processes.

These benefits and drawbacks were clearly evident through the detailed descriptions provided from Quito and London. Some of the challenges related involve the resources – including time, funding and information – required to support a meaningful participatory process. In London, these have been partially addressed through working closely with external champions who, in some cases, have helped to bridge financing gaps when funding for projects has been delayed. In Quito, an online platform has been used to provide additional information that facilitates broader participation, although the city recognizes that not all citizens in this middle-income city have access to the Internet. In Boston, for instance, a forum was used to bring together the business community around Boston Harbor, where commercial real estate owners, major hospitals and universities have made long-term commitments. These groups have been around for a long time and expect to be around for many years, so they are "a very good group of people to work with on adaptation" (April 21 AM Session 1: 25-26).

Aligned with the need for resources, the representatives at the meeting questioned the role of local government in sustaining participatory programs. They noted that as people become more involved they may expect increasing levels of support from government, but that this may not be feasible given the demands and levels of investment from line departments. Substantial institutional support is required to maintain the sustainability of participatory programs. As one participant noted:

> The point is now we are finding we can't walk away. As the systems get more complex, more people become passionate, more people become involved. Instead of decreasing the amount of local government support that's required, they're expecting more. And that's the point. And so, when you begin to roll that out at a citywide level, it's a different form of operation for us. We're not used to that kind of interaction (April 21 AM Session 1: 22).

Another went on to comment:

> I wonder if, as local government, we have the ability to sustain this at a citywide level, because they're fine at project level. But now, we've got a commitment, having successfully established those community involvement and management to start rolling it

> out. And we have no idea how we're going to sustain it. It's hugely successful, but we have no idea how to sustain it (April 21 AM Session 1: 20).

As these sentiments suggest, participatory processes are critical for generating visibility and commitment across civil society.

Many cities have successfully created these supportive constituencies, but because of the lack of resources and capacity, sustaining these groups, engaging citizens, and designing participatory planning processes for the long-run will be challenging. Other challenges that had been experienced related to the issue of mobile and transient populations in certain urban communities. Highly transient residents often are particularly vulnerable, whether they are living in a basement in Toronto, or on a piece of land beside a drainage channel that floods regularly. However, building a strong participatory program requires an attachment to and investment in a community, while knowledge about appropriate actions takes time to be developed. When residents and investors alike do not envision that they will be in a place in a few years, then, it is difficult to "effectively generate the type of social capital in a community to work on the adaptation issues" (April 21 AM Session 1: 28).

Working with strong and stable partners may be productive for cities as these organizations often can play a crucial role in assisting long-term planning and implementing adaptation priorities. While stable institutions and organizations that have long historical ties to a particular place may be good partners, care also must be taken that the needs of more transient residents continue to be taken into account.

SECTION VI: MANAGING ADAPTATION RESOURCES

Municipal governments are important actors for distributing information about climate risks and mediating between different national government departments and local stakeholders. As a result, local governments play a unique role in promoting widespread support for adaptation initiatives, fostering intergovernmental coordination, and facilitating implementation, both directly and through mainstreaming into ongoing planning and work activities (Anguelovski and Carmin, 2011). Despite the critical role they play, they are often confronted with numerous challenges that limit their ability to identify needs and pursue adaptation options. Cities may lack institutional capacity or have difficulty preventing conflicts among departments over scarce financial resources (Hardoy and Romero-Lankao, 2011).

Financing adaptation remains a substantial challenge for urban areas, with few models or mechanisms for allocating funds to these types of activities (although see Brugmann, 2012). Bilateral development agencies and international development banks are increasingly aware of the importance of working with developing countries to 'climate-proof' their investments. In some instances, this includes urban infrastructure, but it seldom includes support for autonomous activities by city and municipal governments for adaptation planning, the employment of additional staff, or smaller-scale practical interventions. Further, existing international mechanisms for financing responses to climate change in low- and middle-income countries rarely include dedicated funds that can be accessed by sub-national levels of government, while the National Adaptation Programmes of Action (prepared by the Least Developed Countries to highlight specific high priority activities) typically do not recommend interventions in or address the need for financial support in urban areas (Agarwal *et al.* 2012).

This section explores the critical nature of financial resources and support from a variety of sources and levels of government and the scope of administrative authority and responsibility needed to adequately manage these resources. It begins with a discussion of how the urban leaders have accessed resources within their cities and from national governments, international organizations and multilateral agencies. The discussion also highlights challenges in accessing and managing resources.

Financial Support for Urban Adaptation

Cities have made use of government financial support from local, national, and international sources to support adaptation initiatives. However, this was one of the areas of discussion in which there were significant differences between developed and developing country cities. The former were much more likely to be able to allocate existing funds to adaptation-related activities; while the latter were much more likely to be dependent on grants and project funds.

Where available, some cities have allocated discretionary funds to pursue adaptation (April 22 AM Session 2: 3), saved money for "big fixes" (April 20 PM Session 2:9), and integrated adaptation costs into other projects (April 22 AM Session 2: 3). For example, adaptation activities in Seattle are supported by an enterprise fund developed through selling water (April 22 AM Session 2: 3). Similarly, Copenhagen, through a municipal water consumption tax, raised money to pay for consultants and general planning costs associated with improving water transfer and treatment infrastructures (April 22 AM Session 2: 7). Copenhagen was able to select this cost-effective strategy because the city had the political authority implement additional taxes. Some other city governments, though, may not possess this authority;

therefore the scope of autonomous action at the city level depends greatly on the institutional context and landscape of administrative authority in the country for delivery of urban services. In Boston, rather than earmarking funding specifically for adaptation, the City's approach has been to creatively use existing budget allocation mechanisms in ways that support adaptation priorities within each department (April 22 AM Session 2: 2). These two examples highlight variations in approaches: allocating funding from existing budgets on the one hand and creating dedicated funds (based on specific city taxes) for adaptation on the other.

In contexts where there is limited legislative autonomy, or restricted revenue bases, many city officials feel that they have to wait for national governments to allocate financial resources and technological support (April 22 AM Session 1: 30). However, for most, there is a lack of direct support from national governments for urban adaptation (April 22 AM Session 1: 29). Some specific issues are getting attention, particularly disaster risk reduction and water, flood, and waste management (April 22 AM Session 1: 29), though there continues to be a focus on centralized competencies and authorities for addressing these areas. For example, in the case of Taiwan, since flood control and management are national priority issues, cities have the ability to access grant money from the national government that is specifically earmarked for floods (April 22 AM Session 2: 4-5). In contrast (specifically for cities in low- and middle-income nations) relatively few resources are devoted to public health and integrative resilience planning (April 22 AM Session 1: 29). In other cases, while funds may be available for planning efforts and assessments, little is available for actually implementing the plans (April 22 AM Session 1: 30).

A number of multilateral funding sources are targeting municipal governments in developing countries, including the United Nations Capital Development Fund (UNCDF) and the Climate and Development Knowledge Network (CDKN) supported by the UK government's Department for International Development. The UNCDF targets second and third tier cities and provides funds directly to cities to support resilience enhancement measures (April 22 AM Session 1: 31-32). The CDKN provides support for climate resilient development through a client or user-driven approach (April 22 AM Session 1: 33). For example, CDKN funded Quito's local climate change strategy and has used this initiative as a baseline for other adaptation-related projects (April 22 AM Session 1: 34). These two examples illustrate the importance international organizations are beginning to place on support and resources for initiating and sustaining adaptation as discussed in Section II and the types of actions that are themselves undertaken to advance adaptation.

Some cities also have made use of bilateral funding support. In Walvis Bay, for instance, development support from the Danish Government (through DANIDA) was catalytic in creating an environmental fund. In this case, a small amount of funding was influential in generating a larger program of action. However, for modest sums to have this level of impact, the city should have a defined adaptation agenda with ongoing resources and capacity support. This provides a basis for soliciting the money and being able to immediately spend additional funds when they are received (April 22 AM Session 2: 17).

Challenges Associated with External Financial Support

Particularly in developing countries, municipal representatives noted that while funding is important, they often encounter challenges associated with the support they receive. These challenges can be roughly divided into three general categories: the timing of external funding cycles; difficulties in demonstrating and measuring adaptation; and the inability to satisfy reporting requirements and performance metrics.

The timeline associated with the approval and disbursement of funding from external sources often does not match the staff or budgetary cycles of municipal planning and projects. As noted by one participant, external funding approval often takes a long time and is not aligned with local cycles of action:

> Given the operational system of donor protocols, you can get scenarios where two-and-a-half years of a five-year program can be spent just getting approval of the work program. So, they become highly dysfunctional scenarios, because of the bureaucracies associated with the donor environment. They just spend huge amounts of time just trying to do the bureaucratic paperwork upfront to get the approval to spend the money (April 22 AM Session 3:4).

Similarly, if funds are disbursed to local governments through a "trickle-down" mechanism, many national government bureaucracies can be slow and inefficient (April 22 AM Session 3: 4). Some donors and networks, such as ACCCRN, address this time lag by disseminating funds to cities directly rather than going through national governments (April 22 AM Session 2: 9), although this is not yet a common practice.

In terms of the second challenge, demonstrating and measuring adaptation, cities have noted that many external funders still have a relatively poor understanding of adaptation, and are therefore unclear about how to account for it (April 22 AM session 1: 28). In particular, the "measurable, reportable, and verifiable" criteria used by the international community on mitigation actions may not be suitable for adaptation because many adaptive actions cannot immediately be measured or demonstrated. Moreover, there is a scalar mismatch between the call for universal standards and methodologies for demonstrating adaptation and the locally specific nature of actual adaptation priorities. Since adaptation will look different in different cities, municipalities will have to find a balance between international resources that come with predetermined indicators and the need to attend to adaptation priorities that fall outside of those definitions.

The third challenge cities are encountering is adhering to performance metrics stipulated by external funding agencies. In some instances, reporting requirements involve such high levels of staffing capacity that they become a deterrent for actually applying for funds. As expressed by one representative:

> The bulk of our funding is now sourced internally because of the cost-benefit of actually drawing out international funding. When you've got limited staff and so much to do, you waste way too much time. So we now prioritize unconditional grants. (April 22 AM Session 2: 26).

Of course, the adaptation practitioners are not opposed to transparency and accountability mechanisms that ensure funds are actually spent wisely and effectively. For cities, such as Durban, accountability measures are seen as giving external funders more confidence that they have managed the funds appropriately (April 22 AM Session 3: 4). This suggests that the credibility achieved through reporting or what is known as "results-based management" may be seen as paving the way for receiving additional funds in the future (April 22 AM Session 2: 27).

One of the key observations raised about urban adaptation is that funding should not be a "one-size-fits-all" model (April 22 AM Session 3: 3). In particular, external funders should recognize that developing country cities can vary significantly, and will require funds for different purposes. Since localities experience different levels and types of vulnerability to climate change, the current external funding

model has the potential to promote a "race to the bottom" scenario in which cities compete to be the most vulnerable in order to receive financial support. In addition, funders also need to be cognizant of the specific institutional and political contexts and challenges within each city as these have a significant bearing on how and where funds will be spent. In some cases, funding sources with additional stipulations represent an added institutional burden on city governments, whereas accountable city governments are already in a position to make appropriate decisions about how to use more flexible funds in an effective manner.

Staffing and Skill Development Challenges

While funding is important, there also needs to be sufficient staffing and skills to ensure that adaptation programs can be developed and sustained. While funds ensure that there is support for initiatives, relying on external consultants exclusively may not strengthen internal capacity. Advancing adaptation requires communication and public relations skills to ensure understanding and appreciation of the risks. It also requires technical expertise, scientific training, and managerial coordination in order to design and implement a program of action (April 22 PM Session 1: 8). However, some cities, particularly those in developing countries, are finding significant gaps in the training that people are receiving, as well as limited availability of people who have the necessary technical skills, "passion" (April 22 PM Session 1: 6), and commitment to engage with adaptation.

Some cities buffer staff skill limitations by hiring consultants – a process which can also lead to learning by local government employees. In the United States, there are funds that can be allocated for consultants. However, there are tradeoffs to this approach. In Seattle, for example, there is a services budget that can be used for consultants. However, while funds ensure that there is support for initiatives, they do not strengthen internal capacity:

> And I've been somewhat loath to spend that on consultants, partially because I've been trying to build capacity internally. I think the consultants are fantastic, because they can get stuff done for you quickly, and usually in a manner that looks really good, but my objective has been for the long-term, is to try and build that capacity internally (April 22 AM Session 3: 15).

It also takes time to hire and manage consultants. Most departments must follow strict procurement processes to ensure fairness, with the result that managers can spend as much time working with their legal department to arrange a hire as it would to for them to do the work themselves (April 22 AM Session 3: 16). An alternative viewpoint offered was to include a capacity building component when hiring consultants. In Amman, for instance, training for municipal personnel is incorporated within consulting contracts so that the city can do the work independently in the future (April 22 AM Session 3: 16). As these comments suggest, there are tradeoffs that must be addressed in hiring consultants. While the tendency is to have them fill gaps and attend to specific tasks where staff time or capability is limited, engaging them also can be seen as an opportunity to enhance local capacity.

SECTION VII: SUMMARY AND DISCUSSION

The discussions among the urban adaptation leaders illustrate the need for adaptation in cities, demonstrate the importance of support and funding to encourage this process, and highlight the gains that can be achieved through flexible measures, mainstreaming, coordination, and collaboration, and a willingness to work in innovative ways. The discussions also illustrate the vital role played by motivated and committed individuals – working in partnership with politicians, civil society, and the private sector – in driving this policy agenda forward. Adaptation practitioners are encountering many normative models for adaptation planning, most of which are based on speculation and best practices adopted from other fields of action, rather than on experience from practice and empirical evidence. Although there is a need for balanced information and ideas that can be tailored to cities, many of these guidelines provide overly simplistic views of what will work in advancing adaptation in urban contexts.

A point consistently noted by the meeting participants is that they have to negotiate complicated political terrain in order to gain local commitment and establish a credible foundation for adaptation in their cities. At the present time, urban adaptation planning is largely decoupled from national and international policy frameworks. This can hinder progress and limit the legitimacy of local adaptation initiatives. As a result, the participants in the meeting noted that long-term committed and credible engagement from municipal leadership is essential to advancing this agenda. Political leadership also is essential for coordinating across city departments and for fostering a supportive staff environment.

Most recommendations on adaptation planning emphasize the need for conducting assessments of economic, climate change and other environmental, and social risks. The provision of reliable projections is an important component of adaptation planning as this facilitates coordination across scales and, in many cases, generates political support. However, while uncertainty around future climate projections and their local impacts is an issue, it has not hindered action. Instead, many leaders build extra flexibility into their projects, recognizing that knowledge on adaptation is evolving and that they will need to blend structural and nonstructural measures in order to be effective over time. Although assessments are viewed as integral to planning, cities do not always use them to initiate their adaptation processes. While a “rational, linear” approach might start with dedicated assessments and move forward on that foundation, the “practical” realities of urban life require that many gather information, engage departments, and allocate resources to adaptation as opportunities arise – many gains have been made by city authorities responding in an opportunistic manner to particular events or policy windows, and it is valuable for adaptation leaders to be prepared to do this.

Given local differences and the need to be practical, the cities represented at the meeting are following different approaches and trajectories in their adaptation programs. This ranges from incorporating adaptation into general climate change action plans, to developing dedicated sector-based plans, and from creating strategic plans, to integration into departmental and sector plans during routine planning cycles. No matter what approach they are taking, the discussions surfaced a consistent need among the cities to link adaptation to existing plans (including sector plans) and ongoing activities. The leaders further noted the need for finding synergies between adaptation and other domains of action, including climate mitigation efforts, and sustainable development initiatives, as well as to promote mainstreaming with ongoing department work and programs. However, jumping straight to mainstreaming without ensuring that there is an understanding of the uniqueness and complexities of adaptation can undermine

initiatives. Integrating adaptation with other agendas makes adaptation more familiar and also more feasible since city staff members have limited capacity to take on new issues.

Stakeholder engagement is an integral aspect of adaptation planning in most cities. The adaptation leaders acknowledge the importance of engaging the public, but also note that no single approach works in all contexts. In general, many of the innovations and advances made by cities around participatory urban governance have been only partially incorporated in planning for adaptation. While a wider range of options can be employed, those at the meeting highlighted the need for locally relevant approaches and effective timing for participation. The adaptation leaders also expressed concerns about the types of dependencies and demands that can emerge since participatory processes take a lot of time, funding, and information, and, as people become more involved, ongoing support from local government. In terms of the types of participation presented, some cities are working with local neighborhoods, while almost all are forming committees comprised of diverse stakeholders that provide leadership and advice. Membership in these committees tends to include representatives from government departments, state and regional agencies, citizens' groups, civil society organizations, utilities, universities, and research organizations. Some private sector interest and engagement in adaptation is starting to emerge, particularly with respect to insurance, engineering, and real estate industries, as all of these sectors can support adaptation needs and economic interests.

Not surprisingly, financial resources are a critical issue for all cities. Most participants agree that reliable and suitable international and national sources of funding are necessary, but do not anticipate these to be sufficient for all their adaptation needs. In the developing country context, programs that are funded and sponsored by international foundations, international organizations, development banks, and NGOs increasingly are a stimulus for adaptation as well as a source of information and support. Although these programs can be catalytic, they often are not specific to the local context and they do not offer funding at levels that can address existing vulnerabilities. In addition, funding from these sources often is accompanied by rigid stipulations that can limit the ability of a city to make the most appropriate use of the support and by institutional reporting requirements that often divert their efforts away from the central focus of activity. The representatives further commented that in many instances, national government timelines do not mesh with municipal budgetary cycles and trickle-down sources of funds often are slow and inefficient. In response, some cities have devised strategies for obtaining funding through alternative means. These include various internal fiscal transfer mechanisms such as allocating discretionary funds, raising municipal taxes and fees, and partnering with specific municipal department budget committees.

Even at this early stage, cities are recognizing the difficulties associated with demonstrating and measuring adaptation. Since adaptation is ill defined, funders are unclear about how to account for it in their programs. There is also a mismatch between the contextually specific nature of adaptation priorities and an understandable desire among some aid agencies and lending institutions to develop widely applicable principles and practices. One of the concerns expressed by the leaders is the inability to satisfy reporting requirements and adopt performance metrics imposed by funders. These requirements often mean that cities need to divert their staff from other activities to meet funder requirements. Although the representatives at the meeting support transparency and accountability mechanisms, their comments suggest that metrics should take into account the types of measures for which cities already are collecting data or that any new measures developed should be useful to planning.

This report focuses on some of the global trends that are emerging in adaptation planning and implementation. While the nature of the discussions and variation in individual contributions made it

difficult to isolate regional trends, some variations did emerge. These variations between cities sometimes appeared to reflect differences between high-income, middle-income, and low-income cities. In other instances, they were associated with differences in geographical regions and types of projected climate impacts or with national and local political structure and culture. For instance, one key difference that was apparent was the way in which adaptation is framed. While all of the leaders recognize risk and economic vulnerability, those in developing countries also emphasize the importance of social vulnerability and the need for promoting equity. In addition, although most of the cities acknowledged the relationship of adaptation to environmental protection and natural resource availability, those in developed countries focused more on greening and sustainability, while those in developing countries highlighted the links to development. While it is possible to analyze cities according to their economic status, exposure to particular hazards, and government institutions, the overarching trend that emerged across the discussions was that urban adaptation programs must account for these and other factors specific to a given city and be designed so that they are embedded in and responsive to local conditions.

Overall, the discussions highlight a tension that is present in most cities. On the one hand, they need guidance, support, and resources that enable them to have adequate data, dedicated information dissemination, and focused action in preparation for climate impacts. On the other hand, they need programs that respond to local realities and allow them address adaptation in the context of existing goals. Although there are a number of programs being designed to promote adaptation, the comments from the participants at the meeting suggest that cities must find ways to balance traditional modes of planning with new modes of experimentation and innovation.

SECTION VIII: RECOMMENDATIONS

Climate adaptation is becoming increasingly important for maintaining the vitality and viability of cities and the wellbeing of the more than 50 percent of the world's population that lives in urban areas. Although adaptation to climate change is imperative, the newness of policy, planning, and implementation in this arena means that those leading efforts have few guidelines they can follow. Of those guides that are available, most suggest that cities adopt traditional linear decision-making processes, starting with information collection and assessment and ending with implementation. However, in many instances there is a mismatch between the way urban adaptation planning is conceived by those promoting programs and the realities experienced by cities and individuals taking the lead on planning and implementation. This section therefore synthesizes some of the key recommendations arising from the discussions among adaptation leaders that are relevant both to cities developing adaptation programs, and other institutions (including higher levels of government, funding bodies, and international organizations) that wish to support them in this.

The representatives that gathered in Bellagio noted that they have been able to draw from programmatic and prescriptive approaches, but collectively emphasized that taking action in an emerging field requires flexible approaches to planning and implementation and a commitment to evaluating and adjusting action on a continual basis. As a result, they have been engaged in a process of trial and error, one where they are learning from their own efforts, missteps, and achievements, as well as from those in other cities. As summarized in Table 2, the lessons they have learned and shared provide insight in some of the ways in which international, national, and local decision makers can support and advance urban adaptation initiatives.

Table 2: Summary of Lessons Learned for Supporting and Advancing Adaptation

Lessons for International and National Funders and Policy Makers

- Integrate urban adaptation into national and international policy frameworks
- Allocate funds for urban adaptation planning and implementation and ensure that the timing is aligned with municipal cycles
- Ensure ongoing availability of climate data and projections
- Establish streamlined monitoring and measurement systems that support adaptation efforts
- Support rigorous comparative research on adaptation planning and implementation
- Design adaptation programs that can be tailored to city goals, needs, and contexts

Lessons for Urban Adaptation Leaders and Decision Makers

- Demonstrate local commitment to adaptation through policies and statements
- Establish ongoing ties to the scientific community and provide local data for decision makers
- Promote and reward experimentation and innovation
- Foster appropriate modes and meaningful forms of stakeholder engagement
- Identify complementarities of adaptation with departmental and citywide goals and agendas
- Promote flexible approaches to planning and implementation that draw on structural and policy measures
- Obtain information and build staff capacity by participating in regional, national, and global events and networks
- Work to obtain financial resources, but also take advantage of opportunities that arise to advance adaptation in the context of day-to-day activities

Recommendations for International and National Funders and Policy Makers

For urban adaptation to be initiated and sustained, national enabling conditions must be present. National mandates, regulations, and policies support and serve as catalysts for local action. By adopting policy measures, national governments demonstrate that adaptation is a priority and promote local and regional coordination. Policies are critical, but so too are financial resources and national recognition of city efforts. Many adaptation measures will require significant investments in infrastructure and other fundamental natural resource management and development measures. Effective urban adaptation will require new approaches by bilateral and multilateral agencies. This includes ensuring that funding cycles are aligned with municipal needs and that city governments and local civil society have greater input into and autonomy over the use of climate adaptation funds.

Monitoring and measurement systems need to ensure that the defined outputs and objectives of adaptation initiatives are met and that these systems help to advance the achievement of adaptation goals. In general, systems need to be in place to ensure that funds are spent transparently and effectively. However, the approaches employed often require high levels of effort that can require that scarce staff time is reallocated for this purpose. They also can detract from achieving program and citywide goals. Designing systems that support adaptation requires consultation and engagement with cities in order to better understand what constitutes effective adaptation and what data can be readily collected.

Local decision-makers benefit substantially when national and localized climate projections are made available to them. The availability of localized projections of climate change and climate impacts can help city officials understand and identify critical economic, environmental, and social risks and vulnerabilities. This knowledge, in turn, makes it possible for local officials to communicate the need for action, set priorities, and generate political and public support for adaptation. Since cities often cannot afford to pursue dedicated modeling, and since some are finding that they can make significant gains if they have access to regional models, it would be beneficial for national governments to ensure the availability of sufficient and appropriate data.

International and national programs – such as those supported by UN agencies and international foundations – are likely to become increasingly important for helping cities initiate and sustain adaptation. In order for the programs to be designed in ways that are sensitive to diverse urban contexts, and to be refined in ways that enable cities to achieve their adaptation goals, they need to be rooted in empirical evidence. National governments and international organizations and foundations have begun to work with the academic community on program assessment. Supporting rigorous investigations of adaptation programs, both of independent efforts being take by cities and international programs, will lead to richer understanding of what approaches are most successful in different contexts and, in turn, provide a basis for program refinement.

Despite the tendency to seek out overarching protocols, international and national programs must not assume that uniform steps and methods are appropriate in all cities. There is a fine line between recognizing general principles that promote sound adaptation planning and action and creating structures that inhibit the flexibility that has so often been shown to be essential in this process. Cities differ, for instance, with respect to their goals, risks, vulnerabilities, levels of income, political institutions, and social and political dynamics. Exchanges and discussions of the type reported in this report can help to elucidate these underlying principles and provide examples that can be used as catalysts to help other cities initiate their own locally appropriate responses to climate change.

Lessons for Urban Adaptation Leaders and Decision Makers

Just as cities need national support, they also need committed and credible engagement from municipal leadership. Local commitment provides a legitimate foundation for action and a foundation for building coordination across the multiple city departments that need to be involved in adaptation.

City and municipal governments can benefit from establishing ties to the scientific community and accounting for new knowledge about climate impacts in their planning as it becomes available. The lack of scientific certainty in climate projections can create challenges for communicating likely futures and specifying with confidence the nature of investments and actions that should take place. However, rather than deny these challenges or wait for new science, leading cities recognize the presence of uncertainty and account for this in their planning and implementation. Specifically, adaptation in these urban areas is viewed as an evolving knowledge space, one in which new information can be fed as it becomes available. In addition, the framing of vulnerability as a combination of factors – of which the rate and extent of change in average and extremes in climates is just one element – means that a wide range of activities, programs, and flexible initiatives that involve a wide range of city stakeholders can be used to target infrastructure and groups of people most at risk.

Cities need to engage in trial and error, learn from their experience, and account for the opportunities and limitations unique to their particular context. For a number of cities that have made advancements in adaptation planning, this has meant combining overarching adaptation strategies with sector-specific programs of action. In the process of developing plans, these cities have considered key factors, such as financial feasibility and the presence of co-benefits. Cities vary in their reliance on expert input and public engagement based on the underlying politics, types of plans being developed, and engagement in an international program. However, across the globe and within any given city, an array of participatory measures often are present, including committees and task forces, public meetings, workshops and other types of knowledge sharing sessions, competitions, and community-based assessment and adaptation.

Understanding the compatibility across local agendas and the synergies between departmental and citywide goals can promote the advancement of adaptation initiatives. For many city governments, adaptation is not seen as important or as pressing as other local agenda items. Political and citywide priorities that, at first glance, appear to be in opposition to adaptation, or agendas that emphasize different goals, may have alignments that can be highlighted and exploited. For instance, in seeking ways to link agendas, cities in developed countries often find support when they emphasize synergies between adaptation and a green economy, while those in developing countries frequently find it beneficial to highlight how adaptation supports economic development. Just as it is important to link adaptation to citywide goals, it also is essential to find ways in which adaptation supports sector and departmental goals, agendas, and day-to-day work programs. The wide-ranging discussions on mainstreaming climate change adaptation concluded that although this is important for promoting coordination and ongoing progress, this approach should not be taken at the expense of developing a cogent and delineated adaptation agenda.

Finally, the availability of various types of resources shapes, but does not fully determine, the ability of cities to pursue adaptation planning and maintain an adaptation program. Cities with financial resources may be able to pursue large-scale programs and projects as well encourage particular departments to build adaptation responses into their day-to-day activities. The presence of a cadre of adequately trained staff provides expertise that helps cities plan and accomplish specific activities. Trained staff may also be a source of knowledge, promoting the generation and sharing of information that can establish a sound

basis on which officials and planners can develop ways of making their cities more resilient. Encouraging and supporting city staff to continually advance their skills and knowledge, and to learn from each other in regional, national, and global networks, can therefore be an important element of adapting cities to climate change.

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