

ADAPTING CITIES TO CLIMATE CHANGE: OPPORTUNITIES AND CONSTRAINTS (FINDINGS FROM EIGHT CITIES)

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Summary: Adapting cities to climate change has only recently entered the academic and policy debate as an essential and integral part of climate policy. Research has so far concentrated on early practices and ‘proactive’ single cases. Drawing on the experience from eight case cities, this contribution presents a comparative account of the current state of progress to adaptation in cities. It provides evidence on what motivates early movers, cities that have started to develop and implement adaptation plans. And it reveals obstacles to taking on the adaptation challenge. The investigation evolves around the concept of coping capacity, defined as the ability and willingness to manage both the causes of environmental change and the consequences of that change. Lessons for research and policy are derived.

Key Words: Cities, Climate Change Adaptation, Mitigation, Coping Capacity

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I. INTRODUCTION

Since the start of academic and policy debate on more appropriate societal responses to global climate change, adaptation of cities to climate change has not been a prominent issue (IIED, 2007). There was considerable concern that increased attention on adaptation would reduce the pressure for mitigation action – and thus foster (or at least indirectly allow) the continuing emission of anthropogenic greenhouse gases into the atmosphere. This perspective is starting to change. Today, adaptation is increasingly seen as an essential and integral part of proposed and implemented climate policy. The recent IPCC Report (2007, p. 6) states: "There is high agreement and much evidence that with current climate change mitigation policies and related sustainable development practices, global GHG emissions will continue to grow over the next few decades." In the meantime, cities and their residents have no choice other than to adapt to the impacts of climate change. This view coincides with a growing political voice for adaptation mainly in countries and cities that are likely to be affected most severely (Pielke et al., 2007).

Cities around the world have started to initiate adaptation, often irrespective of national frameworks being in place. These early 'proactive' experiences have been studied and documented to some extent (see in particular the Special Issues of Environment and Urbanization, 2007 and, most recently, Habitat Debate, 2009). In this contribution, we intend to go beyond the investigation of single case-study experiences of 'good practices' by capturing the diversity of options that cities have started to implement. Drawing on the experience from eight case cities, this contribution presents a comparative account of the current state of progress to adaptation in cities with respect to a couple of closely related questions: What motivates first movers or cities that have started to develop and implement adaptation plans? In contrast, what are obstacles elsewhere in cities that have so far been more reluctant to take on the adaptation challenge? The case cities in this study were selected to provide diversity/variety in several respects: climatic zones, political-administrative organization, capacity and state of progress on adaptation planning and action. At the same time, they all are large urban agglomerations that can be expected to play an important role in further advancing the adaptation agenda.

The concept of coping capacity, defined as the ability to manage both the causes of environmental change and the consequences of that change, is central to this study (Tompkins and Adger 2005: 564)¹. Coping capacity is dependent on the availability of resources, authority, human capital, social capital, ability to manage information, the availability of technological innovation and public perception of attribution (Yohe, 2001) but also on the normative or motivational context (Haddad, 2005) and human behaviour and choices (Burch and Robinson, 2007). Based on this, we take the view that response action to climate change depends both on the ability and on the willingness of (single and collective) actors to take

¹ The IPCC, in its 2001 has defined climate change as the adjustment in structures, practices or processes, in order to respond to changing climate conditions and effects (IPCC, 2001).

action. Taking this view as the basis, we explore coping capacity to advance the understanding of the portfolios of opportunities and obstacles and how they translate (or not) into responses.

This paper is a synthesis of our findings and contains five sections. First, we provide background information on the selected cases, such as population demographics, spatial extent, administrative organization, annual medium temperature and precipitation, scenario trends and the availability of national and local adaptation frameworks and action plan. Here, we highlight the diversity, but also common connecting themes. The second section reports on the individual exposure of cities to climate change, showing the climate related trends and existing local driving forces. As the cases confirm, climate change adds to existing vulnerabilities. In the third section, we turn to coping capacity and explore how and to what extent cities are integrating the particular challenge of climate change into local strategies and action. This pertains to questions of temporal scales, multi-sectoral structure and coordination, strategic orientation, new priorities and governance arrangements. The fourth section provides the synthesis across cases on the opportunities and motivating factors that drive or obstruct adaptation planning and action. In a final section, we provide some lessons for policy and research. Summary data on the included case cities are provided in the Annexes (pp. 14 – 23). The source papers (individual case reports) are available as separate documents. They are the result of a review of government documents and peer-reviewed research, and interviews.

II. BACKGROUND OF THE CASE STUDIES

Eight cities / city regions are included in the study: Bogotá, Cape Town, Delhi, Pearl River Delta, Pune, Santiago, Sao Paulo and Singapore. They have in common that they represent large urban agglomerations (Annex 2, p.14). Across cases, population ranges between three million (Cape Town and Pune) to 19 million (Sao Paulo). The Pearl River Delta with its nine prefectures of the province of Guangdong has a population of about 60 million people. The population changes in the selected cases reflect the different stages of urbanization. The Latin American cities have already passed their urbanization peak. Annual increase in population has slowed down to less than 2% and takes place mainly in the suburban and peri-urban areas. Asian cities are at an earlier stage of urbanization and show an impressive annual increase in population.

All the eight cases have important political functions as national, regional or provincial capitals. This generally creates more favourable conditions in terms of control over political, financial and administrative resources. However, the internal political-administrative structures and distribution of capacity between local and regional bodies vary significantly from case to case.

Due to their average annual temperatures, their average annual rainfalls and their geographical location, the climate zones range from tropical climate in India with seasonal monsoons to subtropical climates in Sao Paulo and Bogotá, and to mild Mediterranean climate in Santiago.

With Cape Town, Singapore and the Pearl River Delta the study contains only three coastal city regions. With the other five cases being located in non-coastal areas, the study offers the opportunity to study anticipated changes and effects that go beyond sea level rise. Therefore, only these three city regions are directly affected by sea level change. Other expected changes include temperature increase, changing precipitation rates and extreme events like storms, floods. Their impacts will increase over time and will lead to severe risks (IPCC, 2007). An increase of annual median temperatures has been projected for all regions where the cities are

located, and ranges between 2°C and 5°C. An increase of extreme events has been identified for all city cases, including intensity in rain falls, heat waves and storms.

Although action plans on national level exist for all cases – in many cases recently approved - only the cities of Cape Town, Delhi and Sao Paulo have themselves started to formally take up the challenge of including adaptation strategies into their local agenda. The only case where the city adaptation plan has been already approved is Cape Town (2006). Singapore can be treated similarly since the national action plan for the city state likewise serves as local action plan.

III. EXPOSURE TO CLIMATE CHANGE AND ANTICIPATED EFFECTS

This section summarizes the sectors or urban functions where impacts of climate change are anticipated. It likewise summarizes local conditions and trends that reinforce local exposure to climate change (Annex 3, p. 17).

Affected sector/service/use	Bogotá	Cape Town	Delhi	Pearl River Delta	Pune	Santiago	Sao Paulo	Singapore
Water	x	x	x	x	x	x	x	x
Ecosystems	x	x			x			
Food	x	x		x				
Health	x	x	x	x	x	x	x	x
Infrastructure		x	x	x			x	x
Energy			x	x	x	x	x	x
Human settlement (floods, sea level rise)		x	x	x	x	x	x	x

Table 1: Exposure of case cities to climate change impacts (source: authors, see Annex 3, p.17)

As an interesting observation, all case cities are expected to face major stress on water availability. Particular concerns relate to issues of supply scarcity, contamination and salt water infiltration, higher demand and growing dependency on external supply. In a number of cases (Cape Town, Singapore, Santiago) there is explicit reference to potential redistribution conflicts between sectors and population groups. The effects on health are another concern that is present in all cases. Most commonly this is associated with air pollution (Pearl River, Santiago, and Sao Paulo), heat effects (Delhi, Pearl River Delta, Sao Paulo, Pune, and Santiago) and the spread of disease vectors (all cities). The consequences on human settlements due to sea level rise or coastal but also inland flooding is a further concern that could lead to serious disruption in transportation and infrastructure service. As a major ‘knock-on effect’, higher energy demand is identified as an issue primarily in cities within the tropical climate zone. Effects on sensitive ecosystems (fire, degradation) and food security are most notably a concern in Bogotá and Cape Town. Although quantified only for very few cases, economic losses are a cross-cutting effect of climate change.

Interestingly, there is a high convergence in terms of the local conditions and trends that reinforce the anticipative impacts of climate change in the case cities. In-migration to sensitive areas and associated land use change is the major issue. Another common factor is the the adoption of western consumption patterns increases the demand for water, energy, and land. This is mentioned in connection with already high dependency on ‘external supply’ of resources, for example drinking water or energy. A final aspect is the highly inequitable distribution of the associated risks across population groups and locations.

Our findings support the hypothesis that climate change effects add to already existing vulnerabilities, such as the high dependency on scarce resources or the settlements in sensitive ecosystems. These effects are not limited to coastal cities alone. Clearly, effects need to be seen in connection with 'reinforcing' local conditions and factors. Crucial across all cities is water scarcity, in particular where existing supplies are running into deficits (Cape Town, Delhi, Pune, Sao Paulo) leading to worrisome anticipated distributional conflicts.

IV. CITY ADAPTATION CAPACITY AND RESPONSES

This section examines the state of adaptation planning and action for the selected cities. We first examine national level action and then turn to the city or city region level. Here, the description primarily draws on the experiences of cases where a Local Action Plan is approved and being implemented (Cape Town, Singapore) or about to be approved (Delhi, Sao Paulo). This is complemented by information on the national level experience for all eight cases.

We adopt three focal points for the discussion of responses. First, what action do cities take? Second, who are the main actors? Third, what tools and instruments are prescribed and used to implement adaptation action?

1. Action

On the first focal point, we report on the questions of what motivated adaptation; in what fields of urban policy cities take dedicated action; and what is the type of response (Annex 4, p.18).

Looking at national level strategy and action plan preparation, the responses are largely driven by the will to comply with international commitments. In one case (Colombia), there have been financial incentives and technical support. In China and India, the strategy formulation is used to demonstrate international 'leadership'. The case of South Africa is probably somewhat different, where the preparation of national action plan flowed almost directly out of the Western Cape provincial plan.

At the city level, the driving factors of 'early' action vary quite significantly. In Delhi, city managers emphasize the responsibility of the city as global leader. At the same time, they see the opportunity to advance their existing development agenda (basic service provision) through strategically accessing financial instruments (Clean Development Mechanism). In Singapore, adaptation is taken as an opportunity for technological innovation with significant investment in research and development. In Cape Town, the preparation of the Western Cape provincial plan was largely driven by the experience with disasters and the anticipated worsening with climate change. In the case of Sao Paulo, a driving factor is the mayor's involvement in the C40 initiative. This highlights the potential of new ideas, networks and leadership.

With regards to policy fields or sectors where adaptation action is being implemented, plans at the national level normally break down the action plans generally prescribe guidelines for action in sectors. Surprisingly, there is no specific urban focus or agenda, except perhaps in those cases where frameworks and plans have identified coastal areas as a concern.

City level action concentrates on a range of sectors such as water, energy, waste, infrastructure or land use and human settlement, as well as disaster management. A concern across cases is anticipated water supply scarcity. In Cape Town this has led city managers to initiate a range of actions under the adaptation plan to address consumption patterns of residents. Behavioural

change is also a strong emphasis in Singapore with respect to energy consumption. The city likewise initiated several programmes for technology development with regards to water (desalination, recycling) and energy (e.g. solar energy). Aside from linking supply management with demand management, action in all cases displays an increasing awareness for integrating key sectors. Examples are disaster management and land use (Sao Paulo) or land use and transportation (Singapore). In Cape Town, the Framework for adaptation to climate change represents a city-wide and coordinated approach that reviews direct impacts on natural resources, as well as secondary impacts on the socio-economic conditions and livelihood of communities, and references specific strategies in response to the impacts (Mukheibir and Ziervogel 2006). In all cases, the action formulated in the local action plans ties in with (pre-) existing strategies and goals for sustainable development (Cape Town, Singapore) or global competitiveness (Delhi). Likewise, action is legitimized by linking it to problems that are ‘prominent’ and debated in public. An example here is Sao Paulo, where much of the rhetoric links to the transportation situation that attracts much of the public debate. These two aspects (continuity of the agenda, relevance of the topic) seem to be important ‘strategic’ considerations in bringing adaptation action into the mainstream of local development.

With the exception of Cape Town and its clear focus on adaptation with a dedicated ‘framework for adaptation to climate change’, the city-level action cases do not make a clear difference between adaptation and mitigation. There is some indication in Delhi that a focus on mitigation, motivated by tapping opportunities offered by the Clean Development Mechanism, has so far prevented a stronger consideration of adaptation measures.

Looking at the type of response, it is useful to differentiate between accommodating, protecting or retreating action. Coastal case cities facing sea level rise and extreme events seem to favour ‘protective’ approaches (Cape Town, Singapore). With respect to impacts that relate to resource availability and redistribution, accommodating responses are adopted (Cape Town), whereby a main instrument is to adjust (minimize) consumption, or to seek technological solutions. For Sao Paulo, retreating options in the form of resettlement are discussed and written into the local adaptation plan.

2. Actors

For the second focal point we explore which actors are taking the lead; how responses are being coordinated (vertically and horizontally); and how is participation of the public and local communities organized (Annex 5, p.19).

Across all the eight examined cases (national and local level), the lead responsibility for adaptation is attached to governments. In China, a concerted top-down strategy has been developed with the establishment of a “regional administration system” to coordinate local responses to climate change. In all other cases, local responsibility exists independently from national strategies. In the cities with existing local action plans, two principle alternatives have materialized. In Cape Town and Singapore, the lead responsible actor is the agency concerned with the environment (Environmental Resource Management section within the Department of Environmental Affairs, Development and Planning in Cape Town, National Environment Agency in Singapore). This may correspond to the existence of a strong environmental sustainable development agenda. In Sao Paulo, the lead initiative is more in the political domain of the Mayor’s Office. In Sao Paulo, this is explained possibly with the strong personal interest and engagement. For the case of Delhi, the Government of the National Capital

Territory of Delhi is mandated to take up action in several core areas defined by the National Plan. At the city level, the Delhi Climate Action Plan outlines different projects that are taken up by different departments.

In the cities with dedicated local action, the primary mechanism for coordination is the action plan or framework itself. The forms of implementation, however, vary. In some cases (Cape Town, Singapore), technical working groups have the responsibility to advance specific projects such as the Western Cape Reconciliation Strategy Study (WCRSS) to facilitate the reconciliation of predicted future water requirement for a 25-year time horizon. In the case of Sao Paulo, the local action plan prescribes the formation of a dedicated multi-stakeholder committee (Comite Municipal de Mudanca do Clima e Ecoeconomia) under the Environment Department.

The task of engaging the private sector, civil society and local communities is addressed in different ways and motivations across and within cities (even with project-specific variability within cities). In Cape Town, the WCRSS involved the citizens through an extensive public engagement process including newspaper advertisements, public meetings, and capacity building efforts, newsletters and workshops with key stakeholders. The objective was to enhance operation and to induce behavioural change in water consumption. In Sao Paulo, the dedicated multi-stakeholder committee explicitly invites the private sector and civil society, as well as the science community to participate. Across all cases, participation is in general rather 'top-down' oriented. This is possibly associated with the situation that, on the one hand, action is perceived as primarily within the domain of the public sector. Another reason is the perceived limited civil society engagement and level of organization, either in general (Singapore, Cape Town) or with respect to adaptation in urban areas in particular. In Sao Paulo, there exists a noticeable sensitivity for climate change and adaptation, but this is largely associated with the issue of the Amazonian rainforest. With respect to local communities and individual citizens, there is evidence across cases that climate change adaptation simply is not connected to individual conditions or lifestyles.

3. Tools and Instruments for Implementation

In our third focal point we review what the knowledge that the plans are based on; how do the actors communicate information and generate awareness; what measures are in place to ensure compliance and evaluation of action; and how the implementation of adaptation projects is financed (Annex 6, p.20)

Perhaps not surprisingly, all existing local plans and resulting projects benefited by some form of research in order to deal with uncertainty of local climate change impacts. In fact, the creation of knowledge to identify challenges to climate change is written into all national action plans. However, there remain fundamental gaps in particular in localizing regional climate scenarios across all cases. The action to close these gaps has been different. Cape Town and Singapore have engaged scientific expertise to study long term local effects of Climate Change. In Delhi, such efforts to better understand local effects are driven by National level initiatives and involve both national and local research institutions. Sao Paulo engaged in a process to elicit local knowledge through a series of stakeholder consultations with the assistance of the International Council for Local Environmental Initiatives (ICLEI) and the Fundacao Getulio Vargas, a local foundation. Related to these initiatives, the research organization FAPESP performed a study on environmental pressures, state and responses.

Clearly all cases (including those that have not yet formulated 'formal' action plans) benefit from 'accessible' presence of research institutions.

The cases pursue options for communicating relevant information and create awareness. The aspects cover for example general information on climate change and the need to adapt, awareness on its relation to consumption patterns or communication of the impacts of concrete climate change related events. Cape Town has probably taken the most extensive initiative in relation to its water demand management activities to gain collaboration by the citizens. The city has engaged in another project, which modelled the physical, biological and social impacts arising from a 'sea-level-event' (inundation) in the city. The quite dramatic results were publicised widely through the local media. The public response to the study has been vociferous on the one hand, where interest groups such as land owners have objected to the report as alarmist, to muted on the other, where the non-affected population regards the scenarios as 'someone else's problem'. Looking across cases, however, the entire field of communication, information and awareness creation appears somewhat neglected even in those cities the topic has been picked up. More commonly, initiative is taken along with related projects, although not linked to a climate change agenda. In Delhi, for example, the 'Clean Yamuna' (river), water harvesting and solar heating projects are being implemented essentially as awareness campaigns.

What measures are in place to ensure compliance and evaluation of action? Singapore has taken initiative to introduce standards such as the Green Mark standard for energy efficient buildings and initiatives to encourage public sector agencies to lead such efforts by carrying out energy audits. Attitude changes and habits are sought in the initiatives being introduced to encourage households to conserve energy. Initiatives that have been introduced include the 10% energy challenge to encourage energy efficient habits. There is Mandatory Energy Labelling for common household appliances to ensure that consumers can make more well-informed choices when they decide on their purchases. Market based instruments are likewise being introduced. The installation of water meters and sliding scale water tariffs in Cape Town are two examples. They are complemented by regulatory measures such as comprehensive water bylaws including the right to enforce water restrictions. The responsible agencies operate compliance teams to monitor and enforce water use.

All climate action plans carry or, in the cases where approval is pending, at least propose discretionary financing for climate action. In some cases, funding mechanisms have been put in place. An example is the 'Air Ambience Fund, financed through a fee on the sales of diesel. The plan in Sao Paulo proposes to utilize 5% of the revenues from newly discovered offshore oil reserves for adaptation. Singapore practices co-payment and co-financing. The state sector in Singapore has always emphasised this form of financing for supporting programmes from housing to transport and health care, among a range of social, environmental and other policies. In Cape Town, the Environmental Resource Management Department has an annual locally funded budget, with contribution from DANIDA.

V. OPPORTUNITIES AND CONSTRAINTS

Next we discuss what motivated the nexus of actors and organizations in the cities that have started to develop and implement adaptation plans. This leads to the assessment of opportunities for local climate action. We also identify obstacles both in cities that have so far

been more reluctant to take on the adaptation challenge and cities with local action plans (Annex 7, p.22). We turn to the opportunities first.

1. Opportunities for adaptation

First, one of the main drivers of adaptation action appears to be a clear **awareness** by local stakeholders of local vulnerability to climate change and the perceived and actual risk. Safety of population and minimizing the impacts of natural disasters are major objectives found in adaptation plans. Initiatives are often linked to concrete experience of disasters, which reinforces predictions about climate impacts and builds awareness of the need for adaptation. The creation of awareness and local knowledge is driven by locally relevant scientific **information**. The identification of risks by downscaling climate models and the analysis of vulnerability generate political interest in understanding how the local climate is likely to change, how the city will be affected and what local response options seem appropriate to confront predicted impacts. In the attempt to address existing uncertainties about climate change impacts, there is significant reliance on university scholars, centres and programs, but also on consensus-building processes with affected stakeholders.

Second, adaptation plans are purposefully used to **support and prioritize already existing strategies**. As Cape Town and Singapore show, this ensures the integration and ‘mainstreaming’ of adaptation action but also it serves as opportunity to advance existing (local) development goals, and thus guarantees continuity instead of radical change in local priorities. The focus, however, seems to vary significantly between cases. In Cape Town, adaptation is connected strongly to existing environmental programs. In Singapore, it supports a strategy for building competitive advantages in technological advancement and innovation. This is an important lesson and a potential starting point for local action in other cities. Our study reveals that, although not explicitly declared as climate action, there exist related initiatives in all cities, to which local climate action can be tied.

Third, adaptation action involves **strong local leadership** that is motivated by the opportunity to become recognized as innovative and future-oriented. Such action is either driven by local politicians or personalities from a leading local government department. One objective is to raise visibility in regional, national and international arenas, as the case of Delhi shows. Another objective is the intention to demonstrate good ‘governance’ to the residents and to bring about innovation in local governance and administration. The City of Cape Town and its slogan ‘the city is working for you’ is an example.

Fourth, local adaptation action strongly builds on **interpersonal interaction to establish confidence in priorities**. The transfer of ideas, knowledge and insight through “external” networks, i.e. international or cross-country cooperation (ICLEI, C40, UCLG etc) as demonstrated in the Case of Sao Paulo is strong across early adapters. Memberships in networks and attendance at conferences go beyond enhancing reputation, as these relationships and events are important sources of ideas and information for cities. Furthermore, early movers utilize diverse types of climate-related events, including “internal” networks in cities, so that information is shared across politicians and departments as well as fostering participation in events at regional, national and international level. This involves strong presence and engagement of NGOs and CBOs.

Fifth, a common practice in the implementation of adaptation plans is the creation of **dedicated climate teams** working within a centralized office and not attached to one specific sector. This

appears to be an adequate treatment of the cross-cutting nature of adaptation and avoids confining adaptation to the responsibilities of one sector (most likely the environment department) alone. An alternative is the creation of a Climate Protection department within the office of the City Mayor, as discussed in Sao Paulo. This reinforces the interdepartmental character of climate impacts.

Finally, **enhancing financial capacities** seems to play a role in driving adaptation responses, but to a lesser degree than one would have expected. Among the eight cases, none of the local action plans has relied on external financial assistance. Expanding financial capacity has been an issue in Delhi in relation to the CDM. At the national level Colombia has benefited from financial assistance in drawing on the national framework.

2. Constraints to adaptation

Shifting our attention to the constraints, there are several lessons arising from the experiences of Bogotá, Pune, Santiago and the Pearl River Delta, but also from the ‘early’ movers.

First, we observe **very limited awareness** with regards to the relevance of climate change for local conditions. In addition, local officials contacted in surveys tend not to establish the (potential) connection between climate change and ‘existing’ development goals. Nor do they make reference to the potential of adaptation planning to address other priorities. In general adaptation to climate change is not seen related to the local development agenda and where these links are reported, they are related to CO₂ mitigation which local officials view as a task in cities in the global North. This perception is mirrored in the opinion held by the public. Awareness is low and climate change, let alone the need to adapt to its consequences, is not viewed as a problem associated with local urban development or connected to personal consumption patterns.

Second, the existing definition and **distribution of political competences** is reported inadequate. This relates both to the local vs. national level, but likewise to the distribution of responsibilities between the various sub-national entities. In all cases, respondents report a ‘multi-level problem with overlapping competences resulting in weak political competences. Although numerous coordination units between these entities exist, they are not defined by a clear division of competences that empower the responsible level. Adaptation to climate change is harder to achieve in such a setting, because the interests of the different entities tend to conflict and do not allow an overall planning process.

A third obstacle is the limited **competences for managing financial resources** at the local level. Even in the cities where local action plans are in place, they do not (with the exception of Cape Town) contain dedicated financing mechanisms. More broadly, there is a reported mismatch between the requirement of adaptation as a local challenge and the availability of local resources. The cases included in this study, despite concentrating large population and functions, have limited degree of autonomy to decide on adaptation action according to priorities. The examples of early adaptation discussed above highlight that setting priorities is a decisive element for adaptation strategies. Setting priorities is primarily a political process and it is more difficult to define priorities if the resources come from an external source, i.e. the national government.

A fourth factor relates to limitations in **administrative competences**. Developing adaptation strategies and implementing them is primarily a task of the public sector that includes the

provision of public goods, such as infrastructure, sanitation, public transportation, housing and social policy. Across cases, constraints relate to issues such as the lack of regulation compelling the private sector to meet minimum social goals and to shared public-private planning. One prerequisite for fulfilling these tasks is adequate and state-of-the-art knowledge and information about (local) climate change impacts including economic costs. The administration in cities like Santiago, Pune or the cities in the Pearl River Delta do not yet possess detailed and downscaled information about climate change impacts across sectors (e.g. infrastructure planning, water provision) and more importantly mechanisms for cross-sectoral coordination in order to properly address the problem of adaptation. Nor do mechanisms exist to capture and integrate existing local knowledge on adaptation that is with affected stakeholders or organized community-based or non-governmental interest groups. As an aggravating factor, the current 'fragmented' institutional structure prohibits a cross-cutting learning process.

A final obstacle relates to the **relevance of national climate action planning for local responses**. From the perspective of city representatives, national plans are prepared primarily as a response to the 'international negotiations and processes of UNFCCC' with a primary focus on mitigation (instead of adaptation). What is more, they largely take a sectoral perspective and, with the exception of reference to coastal areas, have a non-urban bias. In some instances, the national plan has been 'victimized' by conflicting political interests with contradicting and vague results. These arguments raise concerns about the adequacy and legitimacy of national plans in terms of guidance and support.

VI. CONCLUSION

The examination of opportunities and constraints associated with the implementation of local adaptation measures and action plans provides insights on the capacity of local actors to internalize climate change into local responses. The exercise demonstrates that the challenge of climate change adaptation to a large extent connects to and emphasizes existing local development concerns that have been debated for quite some time. For example, the effects of sea level rise, temperature and rainfall change and change in the intensity and frequency of extreme events adds to already existing exposures of population or infrastructure. Likewise, they are inextricably linked with local driving factors that determine vulnerability. Examples are migration, land use change and the inequitable distribution of risks and opportunities across different population groups. Equally, many of the obstacles highlighted here with respect to the political, financial and administrative capacity are not entirely new. They have been identified and discussed in previous contexts, for example connected to decentralization or, more recently, 'good urban governance'.

Aside from re-emphasizing existing necessities, what new insights do we derive?

The cases of Cape Town, Singapore, Delhi and Sao Paulo show that cities (or city states) can play a leading role as forerunners in designing local responses. They highlight the multitude of different options that exist including the instruments to ensure compliance and fund sourcing. And they show how the issue climate change can be integrated into local development strategies. But also the other case teach an important lesson. In each city, there exist opportunities for connect local climate action to already ongoing activities or instruments in areas that present a major concern. Thus, a first lesson for applied research and policy is to better understand these existing local opportunities and the ways to connect them local climate action.

While the cases highlight that local climate action occurs in ‘established’ policy fields or sectors, they demonstrate the need to better address and include the issue of consumption patterns. As the water sector shows, individual and collective preferences can no longer be disconnected from policy and practice of service delivery but rather need to be integrated. All cases included in this survey indicate an intensification of water scarcity in the near or medium future. Thus, a second lesson is that a main strategy to confront this trend will have to focus on adjusting consumption levels as a complement to reuse and recycling schemes.

Connected to this, adaptation will invariably push concerns about distribution of scarce resources across sectors (e.g. domestic water use vs. water use for agriculture) but also across communities and locations further to the forefront of the adaptation debate. This will be particularly true and highly problematic in cities where scarce resources are linked with highly inequitable access of different population groups (Johnston et al 2008). Thus, the third lesson is that policy needs to pay increasing attention on long-term regulation of the distribution of resources use between competing uses and users.

The experience across cities likewise shows the need to find strategies for engaging the citizens in local adaptation action. Probably with the exception of Cape Town, attempts have been moderate and so has been the success. What adds to the task is that citizens do not correlate climate change and local effects with their own preferences and lifestyles. The lessons that follows is that the implementation of local climate action needs to consider communication much more prominent, perhaps needs to use a large variety of communication instruments, and might need to emphasise the links between the local effects of climate change, ‘mainstream development and individual consumption and lifestyles.

Finally, confronting the challenges of climate change will continue to face uncertainties about the direction and magnitude, the effect on levels of exposures and the implications for policy despite attempts to bring climate models down to the local level, Thus, learning how to deal with uncertainty and to design processes that lead to ‘legitimate’ action will be a major new challenge for local action.

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ANNEX 1: CONTRIBUTORS/AUTHORS OF THE CASE CITY REPORTS

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Annex 2: Background Information

Criterion	Bogotá	Cape Town	Delhi	Pearl River Delta	Pune	Santiago	Sao Paulo	Singapore
Population (most recent)	7.887.000 (2005) Metropolitan Area	2.893.248 (2001, census)	13.803.085 (2001) National Capital Territory	Approx. 45 million for the Metropolitan Areas of <u>Guangzhou</u> , <u>Shenzhen</u> , <u>Dongguan</u> , <u>Foshan</u> , <u>Jiangmen</u> , <u>Zhongshan</u> , <u>Zhuhai</u>	3.198.800 (2006)	6.061.185 (2002, census) Metropolitan Region	11.188.646 (2008) Município SP	4.6 million (2005)
Population Change (%)	1.65% increase (2000-2005)	No information	4.7% increase (1991-2001)	No information	25% increase (2001-2006)	0.9% increase (1992-2002)	0,88% increase (2000-2006)	No information
Spatial extent	1.775 sqkm	2.500 sqkm	1.483 sqkm	4.500 sqkm (1.500 sqkm for four major cities of Guangzhou, Shenzhen, Dongguan, Zhongshan)	450 sqkm	15.403 sqkm	1.509 sqkm Município	699 sqkm
Administrative Organization	Capital District With Mayor + 20 District councils elec-ted by popular vote	Provincial capital	Government of National Capital Territory of Delhi	Towns and cities	Pune Municipal Corporation and Pune Cantonm. Board	Regional Government 3 Provinces 52 Municipalities	Municipality of Sao Paulo	City-state
Vegetation (climate) Zone	Sub-tropical	Coastal, Mediterranean,	Indo-Gangetic alluvial plains; seasonal monsoon	Coastal	Seasonal monsoon; biodiversity hotspot	Semi-Arid, mediterranean		Coastal, tropical
annual temperature (average/range)	13.5°C	14.5 °C	31°C. (interseasonal variation, 6°C to 47°C)		20-28°C	14° C (increase by 0.5°C for 1961 – 1991)	15,3-22,8°	Min. 23 deg C Max 34 deg C Diurnal range
Average mean daily temperature (mean 1961-1990)		16,2°C	25°C	22,9°C (for Shenzhen)	24,8°C	14° C	19,3°C	26,7°C
Projected average temperature change IPCC (2007)	2-4°C increase	2-3°C increase in maximum/minimum temperatures (by 2050)	3-4°C increase (by end of century)	3.5°C increase (by the end of the century)	2.5-5°C increase (by the end of the century)	2-4°C increase		

Average annual rainfall	770mm with a bi-seasonal pattern	650-1500mm since 1985, 9 winters with rainfall below 70% of average	611mm	2214.3mm (for Shenzhen)	600-700 mm	376mm	0-274mm	2370 mm
Average sum of monthly rain falls (mean 1960-1991)		520mm	798mm	No Information	724mm	No Information	1455mm	2150mm
Projected annual rainfall change	15% decrease	Up to 20% increase in winter months; 10% runoff decline by 2015	predicted increase of about 10% in Gan-getic plains; not quite clear from regional climate models	1% increase per decade during the 21st century	Increase according to current Regional Climatic Model. New data suggest there could be a decrease.	40% decrease in lower lying areas, less in higher areas	No information	Uncertain, how rainfall patterns will change
Anticipated changes in Extreme Events	Rising intense of rainfall events, heat waves, electrical storms	Increase of already significant number and intensity of storms	Rising intense of rainfall events and total rainfall; heat waves; increased drought; disease transmission	Rising intense of heat waves (increase in number of very hot days + hot nights in summer, decrease of cold days in winter)	Rising intense of rainfall events; heat waves; disease transmission	Rising intense of rainfall events	Rising intense of rainfall events	No information
Sea Level Change	Not applicable	Rise by 2 cm per decade over the last decade, projected at 200 – 900 mm by 2100	Not applicable	Projected at 30 cm by 2030; 40-60 cm by 2050. The Southern part of the Delta lies between -0.3m to 0.4m relative to mean sea level	Not applicable	Not applicable	Not applicable	No information
National Strategy for Climate Change	INAP (Integrated National Adaptation Project), planned 2008-2013, implemented only 2007 (US\$ 400,000 World Bank + Japanese cooperation)	The national climate plan flowed almost directly out of the Western Cape plan	National Environmental Policy 2006, National Action Plan on Climate Change (NAPCC) passed in June 2008	Not existing	National Environmental Policy 2006	Approved 2006	Approved in 2008	No information

National Climate Change Action Plan	Guidelines for a National Climate Change Policy (2002): Improve knowledge, Estimate impacts, Determine adaptation measures; Protect high mountain systems (water), Adapt to sea level rise (coasts and islands), Adapt to changing epidemiological patterns affecting human health (malaria, dengue)	Approved 2008	Core areas defined by the National Action Plan include Solar Energy, Enhanced Energy Efficiency, Sustainable Habitat, Conserving Water, Sustaining the Himalayan Ecosystem, Green India, Sustainable Agriculture, and Strategic Knowledge Platform for Climate Change.	National adaptation plan addressing regional adaptation in coastal zones	Approved June 2008	Approved December 2008	No information	No information
Local/City adaptation plan	Not existing, planned in 2008, not yet included in the recently published Environmental Policy Guidelines	Approved in 2006	“Climate Change Agenda 2009-2012” currently awaiting Prime Minister’s approval	Not existing	Not existing	Not existing	Plano Municipal de Mudancas Climaticas (PMMC); currently awaiting the local council for ratification	Not applicable

Annex 3: Exposure of Cities to Climate Change

Criterion	Bogotá	Cape Town	Delhi	Pearl River Delta	Pune	Santiago	Sao Paulo	Singapore
Anticipated impacts, knock-on effects	Rise in fire risk, in heat effects on population, in disease vectors; Changing crop patterns and food security	Water scarcity and pot. distribution conflicts; Increased energy consumption, Heat related health risks; Increased water use, Flooding (beaches, shorelines, coastal areas, infrastructure), Stresses (fire) on indigenous vegetation	Water shortages; Heat waves; Higher energy demands, Flooding, Rise in disease vectors	Haze pollution + air quality, Regional air pollution exacerbated by (regional) CC; Contamination of local drinking supplies with salt water; Flooding; Water shortage (partly due to loss of mountain glaciers); Heat island effects; Food + energy security; Urban infrastructure (transportation networks) risks; Economic Development risks ²	Water shortages; Energy security challenges; Flooding; Siltation; Heat island effects; Rural transformation; Biodiversity loss; Disease risk	Water scarcity, supply deficit and conflicts, flooding, heat island effects	Spread of vector borne diseases (Dengue, Malaria), higher water demand, higher Energy demand (cooling); Effects on infrastructure, Flooding	Economic infrastructure (port, airport, petrochemical plants, refineries in coastal areas); In case of drier conditions, water supply becomes threatened (water is already purchased from Malaysia); Increase in the spread of vector-borne disease Energy demand
Reinforcing local conditions	In-migration due to civil conflict	High in-migration; adoption of western consumption patterns	Urbanization in vulnerable areas; Rising in-migration; Increasing poverty levels	Regional land use change due to rapid urbanization degrading ecosystem services; Regional climate effects of urbanization Long term droughts (generally, anomalous wet and dry conditions)	Urbanization in vulnerable areas; Rising in-migration; Increasing poverty levels	Urbanization in vulnerable areas; Inequitable exposure to CC impacts across spatial scale and social groups	Unregulated settlement leading to loss of green spaces + vegetation cover; Loss of drainage/retention function of rivers; Building materials in Favelas (corrugated iron roof heats up houses); Extreme spatial difference of living conditions across the city	Land reclamation in the low-lying Island State (addition of 10% to pre-existing area)

² Undefined portion of PRD GDP will be lost due to SLR (World Bank, recent estimates: sea level rise of 1m to 5m would reduce China's GDP by 2.4% to 10.8% (Buys, P. et al)

Annex 4: Response Capacity (Action)

Criterion	Bogotá	Cape Town	Delhi	Pearl River Delta	Pune	Santiago	Sao Paulo	Singapore
What motivated Action	External funding for the National Adaptation Project	Existing threats; Experiences with disasters	Perceived role as leader and a global city; Urgent need to address problems related to basic services provision and opportunity to capitalize on CDM and other financial mechanisms	Scientific findings + consensus on CC risks; International collaboration (UN-FCCC (common but differentiated responsibilities), IPCC, UK's DFID); Participation in international environmental agreements; Establishment of a National Leading Committee on CC; National plan is first climate plan from a developing country	No climate change motivators; Poverty alleviation, Disaster management	On National level: response to international commitments (OECD, UN)	Mayor brought back the idea from a C40 meeting	Adaptation as the continuation of a well established long-term/coordinated planning approach
Policy Fields where dedicated Climate Action has been introduced	No information	Water resources conservation and consumption; Disaster management/preparedness	"Air Ambience Fund" to promote clean air policies.;Transportation (CNG buses), Energy sector (greater reliance on solar, shutting down some coal powered plants), Water (rain-water harvesting, solar heaters), Waste management (inter-ceptor sewer canals)	No urban policy but China's National Climate Change Program (national policy established by central government)	No dedicated CC action; Sectoral interventions in flooding, water supply and transport (mitigation: Bus Rapid Transit)	No dedicated plan of action	Disaster management; Vulnerability analyses; Plan 'Parque Lineares'; Transportation, Energy, Waste Management, Health, Building standards, Land use/Resettlement	Infrastructure Planning: Drainage, recent tidal barrier and reservoir; Transportation coordinated land use (short distances); Energy efficiency (technology, audits, standards, behaviour change); Water supply (desalination, recycling); Urban Greening
Type of Action	No dedicated action; Pre-existing sectoral initiatives	Adaptation linked to goal and ongoing initiatives of reducing vulnerability and sustainability; Pro-active and protecting; Knowledge driven	Action plans primarily focused on mitigation, strongly driven by need to tap opportunities offered by CDM. Adaptation linked to existing development concerns and largely follows a sectoral approach.	Ecosystem protection, disaster prevention + reduction, and other key infrastructure construction (anti-flood safety of large rivers, key cities + regions, guarantee safe drinking water + sound social + economic development.); Technological advancement	No dedicated action; Pre-existing sectoral initiatives. Shifting of slums along flood prone river bed; Bus Rapid Transport System	No dedicated action; Pre-existing sectoral initiatives	Adaptation linked to prominent concerns (transportation); Mix of retreating, accommodating, and protecting; Short term + project orientation	Protecting; Linking with Science and Technology

Annex 5: Response Capacity (Actors)

Criterion	Bogotá	Cape Town	Delhi	Pearl River Delta	Pune	Santiago	Sao Paulo	Singapore
Lead agency	Mayor; Regional Autonomous Corp. of Cundinamarca	City Environment Department	Government of National Capital Territory of Delhi, man-dated to take up action in following core areas defined by the National Plan: Solar Energy, Enhanced Energy Efficiency, Sustainable Habitat, Conserving Water, Green India, and Strategic Knowledge Platform for CC	Top-tier of the hierarchy (national government); National Leading Group to address CC, headed by the Chinese premier, was set up in 2007 to draw up important strategies, policies and measures related to CC, and coordinate the solving of major problems	Pune Municipal Corp.	National Environment Agency (CONAMA)	City Government (Prefeitura de Cidade de Sao Paulo), Mayor's office, Lead delegated to the Environment Department	National Environment Agency (NEA)
Principal participants	National Environment Council; Environmental District Secretariat; Emergency Prevention and Attention Directorate	Local Authority Departments; Provincial Departments, Consultant teams	Department of Environment, Department of Power, Public Works Department, Delhi Jal board (autonomous water management agency), Delhi Transportation Corporation, NGOs	Supported by a regional governance system; In 2007, the State Council called on all regions and departments to strictly implement the National Plan for Coping with Climate Change	Pimpri Chinchwad Municipal Corp., cantonment administrations; Maharashtra State Electricity Board; Maharashtra Housing Development Agency; NGOs	Government Ministries and Agencies	ICLEI, Fundacao Getulio Vargas FADESP (Research Institute) Ministerio de Saneamiento e Energia (Estado de Sao Paulo	State agencies with authority over land use + transport development + building controls; CS tends to be small in terms of membership numbers + resources: Public sector: strong support for state initiative as they converge with their own priorities
Coordination mechanisms		Formation of technical working groups	At national level Prime Minister's advisory council on CC provides overall coordination of action plans; Lead agency for implementation is Ministry of Environment and Forests. At city level: Climate action plan outlined different projects that are taken up by different departments.	Plan's presence and mandate for regional application will motivate action at the local level.; Establishment of a regional administration system for coordinating the work in response to CC, to fulfill and implement the national program, to organize and coordinate local activities + actions in response to CC; building local expert group on CC	Potential advisory by citizen groups to the Pune Municipal Corporation of environment related NGO's.	National CC Committee under the CONAMA; Agriculture and CC Committee (Min. Agriculture)	Comite Municipal de Mudanca do Clima e Ecoeconomia (municipal Government, SP State, Civil Society, Private Sector, Science Community),	
How participation is organized		interactive workshops	Largely top-down, occasional meetings of core participants.		Meetings at the Pune Municipal Corporation	Few meetings of core participants	Possibility to participate in the Committee	

Annex 6: Response Capacity (Tools)

Criterion	Bogotá	Cape Town	Delhi	Pearl River Delta	Pune	Santiago	Sao Paulo	Singapore
Information flows, awareness creation and communication		Dedicated awareness campaign: newspaper, adverts, public meetings, capacity building, newsletters	No dedicated climate change awareness programs; Several “stad alone” environmental awareness programs, e.g. clean Yamuna campaign, water harvesting + solar heater campaigns, National Action Plan proposed creation of integrated National Knowledge Network consisting of relevant ministries, experts from industry and academia, +civil society organizations.	Chinese government set up special institutions to deal with climate change in 1990, and established the National Coordination Committee on Climate Change (NCCCC) in 1998	Experts from University Departments of Environment, NGO’s	Limited to technical information; No regional/local communication	Website by the municipal government, Perception that information is only accessible if the user knows that it is there	
Links to existing urban policy instruments		For water, expansion of existing sector policies	Delhi Master Plan 2021, Jawaharlal Nehru National Urban Renewal Mission (JNNURM)		Annual Environment Status Report JNNURM (Jawaharlal Nehru National Urban Renewal Mission)	National Action Plan links to water management, infrastructure, regulatory plans and energy policy	Land use plan	Link to Research and Development in water technologies (desalination, recycling of sewage water) + energy (focus on alternative energy technologies), Urban Greenery (rooftop)
Knowledge basis, on which plan was prepared		Water: Western Cape Reconciliation Strategy Study (25 years time horizon), Sea level rise: Risk Assessment Project to model and understand impacts	Draws heavily on IPCC reports; Research at Tata Energy Research Institute; Indian Institute of Tropical Meteorology, other research centres + local universities; National Mission on Strategic Knowledge to be set.		Fragmented research, e.g. urbanisation, heat island; no local administration documentation	No regional adaptation evaluation to-date, no specific consideration of urban areas	Plan based on a process of consultation, stakeholder participation, expert involvement, literature review, strong role of ‘external’ support (ICLEI) + Getulio Vargas	Study on understanding long-term effects of CC in 2007, led by the Tropical Marine Science Institute, contracted by the National Environment Agency (NEA)

Implementation (compliance mechanisms, monitoring etc.)		Water: comprehend-sive water bylaws include a range of tools: right to set water price, install water meters, enforce water restriction, etc.; Sea level rise: discussed, for example making use of breakwaters compulsory	Mix of regulatory instruments (e.g. solar water heaters made mandatory in all buildings on area of over 500 sqm; digging of bore wells for individual use banned in Delhi, allowed only for community use); Market based instruments (e.g. fee on sale of diesel, proposed introduction of congestion fees).	Mentioned in the national plan but with no concrete strategy (the Plan suggests a need for international technology transfers)	Not in place	Sectoral investment programs in flood mitigation, energy mix, biodiversity management		Various mechanisms
Financing	Existing emergency funding budget	Discretionary budget	Mitigation efforts to be funded through carbon market financing, CDMs, private participation to be encouraged through venture funds, Air Ambience Fund: financed through fee on sale of diesel; Transport Development Fund (TDF) funded through tax receipts from registration charges and proposed congestion fees.; Funding for adaptation linked to existing urban development projects (such as JNNURM) and Department of Environment funding; State government assistance to all low-income group colonies for greening residential areas.		Jawaharlal Nehru National Urban Renewal Mission (JNNURM)	No dedicated budget for adaptation	Fundo Municipal de Verde e Meio Ambiente	

Annex 7: Opportunities and Constraints

Criterion	Opportunities	Constraints
Bogotá	<ul style="list-style-type: none"> - Strong emergency management structure - Clear territorial authority structure(role of mayor and regional corporation) 	<ul style="list-style-type: none"> - Civil conflict and migration patterns - Vulnerability to wide range of natural disasters due to localisation
Cape Town	<ul style="list-style-type: none"> - Motivation primarily internal: existing threats that will be exacerbated, experiences with disasters - Dealing with existing (but exacerbating) vulnerabilities in government is not actively seeking profile in this regard, but rather trying to develop a social conscience - the city's motto is "the city working for you" - Environmental awareness in the W Cape has always been high, due the beauty and very threatened natural vegetation. - There is a very highly qualified academic base in the local universities. The City and province have in most instances been receptive to scientific input and have established committees and fora for discussing the issues 	<ul style="list-style-type: none"> - Foresight required in terms of SLR: officials and politicians are less likely to respond to the threat of a distant disaster than a more immediate one - Citizen's involvement, 'social component' largely unrepresented in CT, thus there is little to build on, but public awareness and pressure from NGOs growing
Delhi	<ul style="list-style-type: none"> - International role in CC fora, building profile of a global city and leadership role in CC - Strong motivation to tap financial opportunities through CDM - Links with existing urban renewal missions such as JNNURM - Existing Bhagidari initiatives in priority areas, rising local awareness 	<ul style="list-style-type: none"> - Rapid in-migration (20-25% slum dwellers, higher vulnerability) - Limited local revenue-raising capacity; complex relationship with neighbouring states in National Capital Region; weak coordination among departments, CC seen as a distant problem while development needs perceived to be more pressing
Pearl River Delta	<ul style="list-style-type: none"> - The national plan is advertised as the first climate plan from a developing country. Its presence and mandate for regional application will motivate action at the local level. 	<ul style="list-style-type: none"> - National Plan is lacking on the urban adaptation front (very few references to city adaptation action – suggested local government action is mostly connected to agricultural sector adaptation and the protection of coastal zones) - Emphasis on mitigation action in National Plan (although the Plan clearly states the principle “To place equal emphasis on both mitigation and adaptation”, the text leans toward the former) - Emphasis on adaptation for agricultural production in National Plan (protecting yields for wheat, rice and maize); strengthening forest /wetland conservation is also considered as enhancing adaptation capacities. - Reduced governability capacity due to extremely rapid urbanization with limited control (comprehensive plans do not guide the observed levels of urbanization) - Top-down governance structure (a five-tier hierarchical structure) imposes limits for local action. - Policies are implemented differentially at the local level (spatial differentiation of governance) - Lack of an independent budget for energy saving, environment protection and adaptation at local level: To finance the activities of energy saving, environment protection and adaptation in a stable manner, a separate account and budget for such activity is necessary to make it a transparent and long run effort by the local government. (Teng and Gu, 2008) - Global market forces and local government needs: Economic competition among regions and special economic zones increases the probability of no-action (China insists on not sacrificing economic growth)

Pune	<ul style="list-style-type: none"> - Traditional water management systems (e.g. harvesting) - Investments through Jawaharlal Nehru National Urban Renewal Mission (JNNURM) 	<ul style="list-style-type: none"> - High poverty levels, increasing vulnerability - Rapid in-migration (+50% PMC, 1991-2001) and unplanned settlements (40% slum dwellers) - Weak coordination between local authorities - Low levels of CC awareness - Opposition from selected interest groups
Santiago	<ul style="list-style-type: none"> - Rising (local) research awareness - Incorporation into (national) political discourse - Engagement within regional Planning instruments 	<ul style="list-style-type: none"> - Institutional structure with limited regional executive decision authority - Low awareness and communication - Non-urban bias in national adaptation
Sao Paulo	<ul style="list-style-type: none"> - Leadership (Mayor) - Attach the issue of adaptation to 'prominent' and cross-cutting problems (transportation, project 'Parques Lineares') 	<ul style="list-style-type: none"> - Adaptation is not a priority, both in general and in relation to mitigation; - National level and regional level not perceived as meaningful support for adaptation agenda; national level too much concerned with international negotiations than with 'local' concerns; - Distribution of competences between municipality, state of S.P. and National Government; (partly limited competences of local government in its own area of jurisdiction, area of concern exceeds municipal area), proposal to create a metropolitan government - Lack of scientific knowledge on vulnerability; - Lack of understanding of concept of adaptation and the potential to solve 'other' priorities; - Lack of knowledge on economic implications (action, inaction); - Conflict of interests (political leaders at local, regional, national level belong to different parties); - Short term 'project' orientation - General: lack of enforcement - Awareness (problems seen not related to CC, and CC not related to personal consumption patterns)
Singapore	<ul style="list-style-type: none"> - Technology development - 'Tradition' of foresight planning 	