

Mainstreaming Urban Resilience Planning in Indian Cities

A Policy Perspective

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The Energy and Resources Institute



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Disclaimer:

This publication was prepared with support from the Rockefeller Foundation as part of the Asian Cities Climate Change Resilience Network (ACCCRN). The ACCCRN aims to catalyse attention, funding, and action on building climate change resilience for poor and vulnerable people in cities by creating robust models and methodologies for assessing and addressing risk, by actively engaging with and analysing 10 cities in Asia. The ACCCRN programme engages local level and national organizations in India, Indonesia, Thailand, and Vietnam, and was conceived and launched by The Rockefeller Foundation in 2008.

TERI was appointed as the National Policy Adviser to the ACCCRN in India in 2009. This synthesis review was prepared from TERI's study on the urban development policy environment in India, and the needs and requirements for integrating resilience planning in Indian cities. The report also draws from TERI's experiences from various city advisory committee meetings that were held under the ACCCRN's Phase I in India, and mostly reflect the experiences from consultations in the cities of Gorakhpur and Indore. The synthesis also includes views and suggestions that were received during two roundtable meetings organized by TERI involving policy makers and funding organizations working on similar themes in India.

Any comments and questions on this publication can be directed to divyas@teri.res.in

Contents

1. CONCEPT	1
1.1 Vulnerability, adaptive capacity, and resilience	1
1.2 Impact of climate change on urban areas	1
1.3 The challenge of resilience in urban cities	2
2. PROJECT RATIONALE AND APPROACH	2
2.1 Objectives and rationale	2
2.2 Approach	2
3. URBAN RESILIENCE PLANNING	3
3.1 Spheres of urban planning in India	3
3.2 Multi-tiered governance structure	5
4. MAINSTREAMING RESILIENCE PLANNING IN INDIAN CITIES	6
4.1 Responding to uncertainty and long time-scales	6
4.2 Entry points for mainstreaming resilience planning in urban India	7
4.2.1 National level	7
4.2.2 State level	12
4.2.3 City level	13
4.2.4 Vulnerability assessment in ACCCRN cities	14
4.2.5 Climate risk screening	14
5. WAY FORWARD	15
Bibliography	17

Preface

The current world urban population is 3.6 billion. In the future, city populations will further grow exponentially. Most of this rapid growth is expected in Asia and Africa. Due to this rapid population growth and large-scale developmental and economic investments, cities are at high risk to the impacts of climate change. Many cities have thus started planning for specific adaptation and mitigation strategies and plans with a view to build long-term resilience to climate change impacts. Studying urban resilience forms an interesting case in context because not only are cities huge emitters and consumers of energy but they are also going to be maximally impacted as they contain large populations and are areas of large-scale economic investments. The Asian Cities Climate Change Resilience Network (ACCCRN) is part of the Rockefeller Foundation's Climate Change Resilience Initiative. It aims to shape and substantiate strategies to help vulnerable urban communities cope with the impacts of climate change by creating robust action models of climate change resilience.

The report, 'Mainstreaming Resilience Planning in Indian Cities' is a result of TERI's contribution to the overall goal of ACCCRN. The report discusses the components of resilience planning in an urban environment.

It begins by presenting concepts of mainstreaming, urban vulnerability, and resilience, thus placing the conceptual understanding of resilience within the current policy context and institutional structure in Indian cities. The various spheres of urban planning in India have been adapted from a previous work of TERI on building city adaptation framework for Indian cities (TERI, 2009b). The activities of public and private players have been clubbed as 'proactive' and 'reactive' to indicate whether actions are being carried out in advance of anticipated impacts or in response to actual climate impacts.

The report further attempts to provide a review of policies and programmes that are functional at the national, state, and city level and that offer potential entry points for mainstreaming resilience into urban development and planning. While some of these policies and programmes explicitly address climate concerns, others do so indirectly and offer co-benefits.

The last section follows a discussion format and presents possible steps that can be undertaken for developing a city-wise strategy.

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1. Concept

1.1 Vulnerability, adaptive capacity, and resilience

Policymakers and developmental planners have increasingly become interested in understanding the concepts of resilience, vulnerability, and adaptation to enable proactive and better informed responses to urban disasters. (Dayton-Johnson, 2004).

Vulnerability to a climatic stressor is essentially a composite of exposure, degree of sensitivity to the stressor, and the ability of the exposed system to cope with the stressor. As the conditions in cities across the world differ in terms of exposure, sensitivity, and adaptive capacity, these differential vulnerabilities will need differential policy responses.

While some schools of thought consider resilience as the main component of adaptive capacity, others view adaptive capacity as a key determinant of vulnerability or both, resilience and adaptive capacity, under the aegis of vulnerability. According to the UNISDR terminology on disaster risk reduction (2009), resilience can be defined as:

The ability of a system, community, or society exposed to hazards to resist, absorb, accommodate to, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.

1.2 Impact of climate change on urban areas

Cities across the world, due to their rapid population growth and large-scale developmental and economic investments, are at high risk to the impacts of climate change. The world population is projected to rise to 9.3 billion by 2050. The population living in urban areas is projected to increase from 3.6 billion in 2011 to 6.3 billion by 2050 (World Urbanisation Prospects, 2011¹). Most of this rapid growth will take place in the urban areas of Asia and Africa. The urban population will increase by 1.4 billion in Asia and by 0.9 billion in Africa. Though mega-cities will continue to grow, the bulk of this population expansion is expected to be in medium (population between 1–5 million) and small cities (population < 500,000). This would result in

Sea Level Rise (SLR) and Extreme events <Box>

By the end of the 21st century, a rise in the global mean sea level, between the range of 0.18 to 0.59 meters, has been projected by various IPCC models. There will be regional variations in the level of rise owing to factors such as population density, slope of the coast, and economic activities along the coast. The UN-HABITAT estimates there are 3,351 low-lying coastal cities across the world. Among the top 10, in terms of population exposed to coastal flood hazard, two Indian cities feature in the list – Mumbai and Kolkata. India's 7,500 km long coastline accommodates more than a 100 million people. fifty-three Indian cities have a population of more than a million (2011 Census) and 25 of these cities are in the coastal states.

¹ World Population Prospects: The 2011 Revision, Highlights. (United Nations publication, ESA/P/WP/224). http://esa.un.org/unup/pdf/WUP2011_Highlights.pdf

an increase in dependency on urban services, economic opportunities, resources, and infrastructure. In India, while cities such as Mumbai, Bangalore, Ahmedabad, and Chennai have substantial developmental investments, medium and small towns are grappling to deal with population growth and competition for resources due to inadequate infrastructure and financial resources. It is projected that by the 2060s nearly 500 million people will be added to an estimated 7,000 and 12,000 urban settlements in India (McGraham et al., 2007).

1.3 The challenge of resilience in urban cities

A major challenge for cities facing rapid population growth is to maintain environmental sustainability. A review of a large body of literature indicates that some factors that make cities sustainable include the presence of robust urban infrastructure, good governance and legal framework, participatory approaches for multi-stakeholder interactions, and replicability of best practices (TERI, 2009a).

Given the nature of inter-linkages of services within an urban environment and consequently the highly connected nature of risks, policies relating to urban resilience and sustainability essentially need to address multiple sectors and dimensions (Nijkamp and Finco, 2000). This includes, for example, land use planning, energy management, ecosystem services, housing and transport, water supply and sanitation, health services, and waste management, inter alia.

Urban resilience can be defined as the degree to which cities are able to tolerate alteration before reorganizing around a new set of structures and processes (Alberti et al., 2003).

2. Project Rationale and Approach

The Expert Meeting on Human Settlement, Water, Energy, and Transport Infrastructure: Mitigation and Adaptation Strategies as part of the Thirtieth Session of the IPCC (held from 21–23 April 2009) for the Fifth Assessment Report (AR5) emphasized that the AR5 will explore the specific role of urban planning for adaptation and mitigation. *In this light, initiatives such as ACCCRN are very timely to inform the AR5 research with a regional perspective from Asia.*

2.1 Objectives and rationale

Within the overall goal of the ACCCRN, TERI's role envisaged a review of relevant policies and programmes of the Government of India to identify entry points for mainstreaming climate change resilience by assessing current and future needs. The rationale is to identify linkages between developmental needs and challenges, and climate adaptation, mitigation, and risk reduction efforts. Furthermore, such a policy review seeks to position activities at the city level so that they are consistent with, and contribute to, emerging national policies related to urban areas and in the process enable the cities to develop their own programmes to access relevant sources of funding from the government or international agencies.

2.2 Approach

To achieve the project objectives, a literature review was conducted to understand how different cities globally and in India have attempted to mainstream urban resilience into urban development. The literature review has also been supported by direct interactions with a number of researchers, policymakers, and urban planners

working in the field of climate change impacts, vulnerability and adaptation, urban development, and planning. This report has also gained immensely from the city-level consultations and interactions with city officials and other stakeholders from Gorakhpur, Surat, and Indore.

3. Urban Resilience Planning

Risks posed by changes in climatic variables can exacerbate the multitude of pressures that some of the cities in India already face in the form of rapid economic growth, inadequate infrastructure, social amenities, and resources such as land and water (TERI, 2009a). The city of Mumbai is an example of massive land reclamation from the sea to meet the demands for space consequent to the rise in population and economic growth. Apart from the climatic risks faced by the city, the drastic landscape alteration in Mumbai has put the ecosystems lying between the high tide and low tide lines at high risk (Srivastava, 2002). Hence, it is important to develop urban resilience plans considering the multiple stresses faced by the cities in order to make them sustainable (TERI, 2009b). Basic services including water (management, supply, and resources), solid waste management, transport and other infrastructure, energy, health, and education are some of the critical areas of intervention while trying to build resilience in cities. Land-use planning, structural systems, infrastructure, communication systems, population, and governance are particularly important.

Aggregating and summarizing the findings from the extensive review of literature on climate adaptation, resilience efforts, urban risks, and development, we find:

- Resilience is **multi-sectoral**: Policies need to be integrated within on-going decision-making and planning processes in critical sectors
- Resilience is an **incremental** process: Planning should emphasize mechanisms for on-going learning, evaluation, and adjustment of strategies based on observed impacts of climate changes
- Resilience includes not only “hard infrastructural investments” but also “soft” actions to **strengthen the adaptive capacity** of populations and sectors
- Resilience should be framed in line with local and regional developmental priorities, and **focus on the most vulnerable sectors**
- Resilience planning should **involve stakeholder groups** in a collaborative way. It is a multi-sectoral approach, operating at various levels of institutional set-up
- Mainstreaming resilience planning needs to be guided by **policies and legislative framework** or by the rules of law to help integration with development activities at each level.
- Resilience planning should be based on detailed **region-specific vulnerability analysis** to capture vulnerability in its varied dimensions (for example biophysical, social, technological, etc.)

3.1 Spheres of urban planning in India

In 2009, TERI conducted an in-house study on designing a city adaptation framework for Indian cities (TERI, 2009b) and synthesized the various spheres of urban planning in India, including public and private agencies as well as individuals that are involved in framing, planning for, and responding to climate change. Table 1, adopted from TERI (2009b), attempts to categorize their mandates and demonstrates the multiple layers of actors and institutions involved. **The activities in Table 1 have been clubbed as “proactive” and “reactive” to indicate whether actions are being carried out in advance of anticipated impacts or in response to actual climate impacts.** By defi-

dition, all “proactive” activities are strategic to some extent, but the table attempts to distinguish between efforts in which climate change considerations are explicitly driving the creation of strategic plans and policies versus efforts to “climate-proof” on-going policies and programmes.

Table 1: Contextualizing adaptation within institutional and theoretical frameworks

Sphere	Driver of action	Approach to resilience planning and action			
		Reactive (driven by current understanding of hazards/ extreme events)		Proactive (driven by future-oriented climate scenarios/ models)	
		Disaster response/ recovery	Measures to reduce hazard risk/vulnerability, based on present hazards	Development priority-driven “climate proofing”	Climate forecast scenario-driven strategic planning to build resilience
Public	Central climate change office (“climate Czar” or integrated high-level task force) at national, state, and/ or city level		Centrally coordinated hazard reduction measures in response to major storm event	Climate considerations built into city spatial/master planning processes	National or state level: NAPAs, state climate change strategies City level: City-wide integrated strategic climate adaptation planning
	Sectoral ministry or agency (e.g. Environment, Urban, Agriculture, etc.) at national, state and/ or city level	Disaster relief support in the wake of climate events (major floods, drought-induced famines, etc.)	Hazard management agency driven disaster-response planning (not traditionally looking at climate projections)	Agency-specific climate mainstreaming to integrate climate change considerations into sectoral policies and planning processes	Sector-driven strategic climate adaptation plans (agriculture, water resources, etc.) Environmental agency research efforts
Private	Private developer/ insurer	Coping/ recuperating losses in wake of an extreme event		Project-level climate proofing activities	Insurance premiums and other market tools to incentivize private development away from high-risk areas
	Neighbourhood and household level	Coping in the wake of an extreme event	Actions to reduce future household-level vulnerability following experience with extreme event	Community or NGO-led activities to weatherize homes, reduce energy use, etc.	Neighbourhood-level planning and monitoring on energy/water consumption

Source: TERI, 2009b

3.2 Multi-tiered governance structure

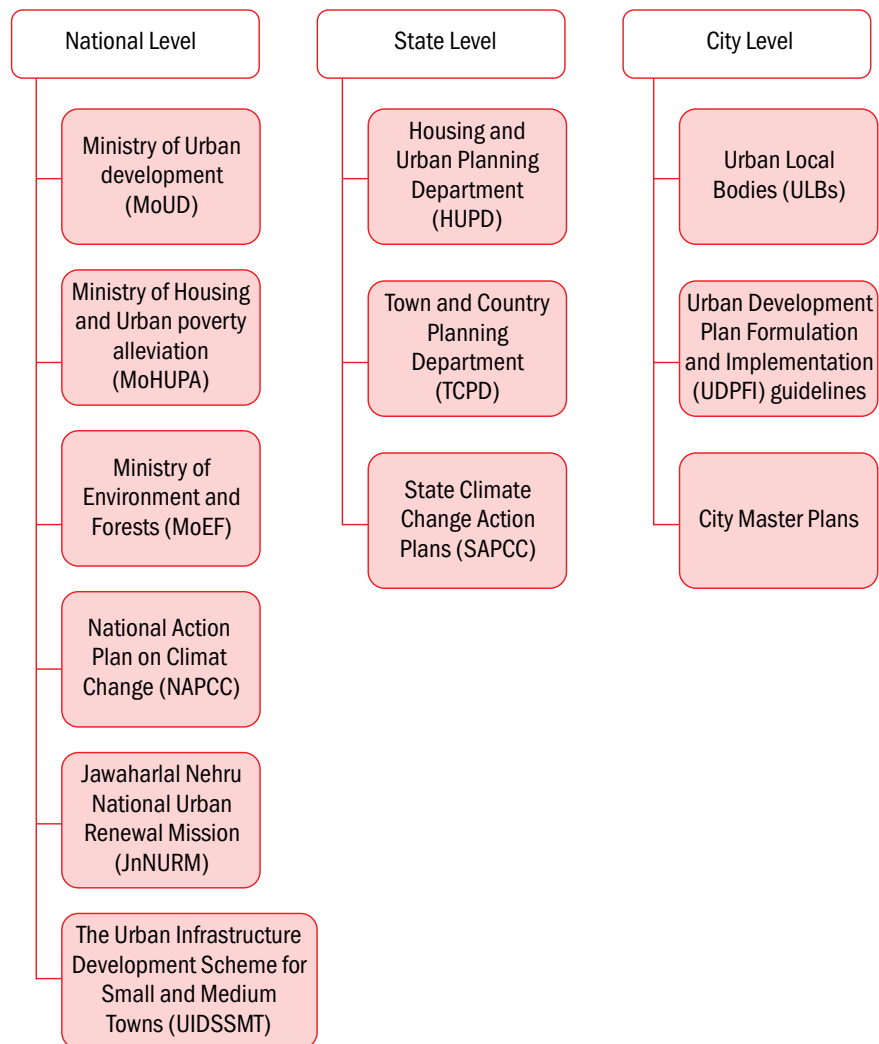
The Indian polity has a federal structure under which national-level policies are decided by the Government of India which also allocates resources to the state governments through various centrally sponsored schemes, provides finances through national financial institutions, and supports various external assistance programmes for urban development and housing in the country. City governments undeniably play central role in planning for urban climate adaptation, with direct jurisdiction over many urban policies that drive public and private development activities and provide basic services at the city scale.

Two central ministries of the Government of India are primarily entrusted with activities related to the urban development, housing, and urban poverty alleviation mandate of the country:

- Ministry of Urban Development (MoUD): The MoUD is responsible for formulating policies, supporting programmes, monitoring programmes, and coordinating the activities of various central ministries, state governments, and other nodal authorities, related to urban development issues in the country.
- Ministry of Housing and Urban Poverty Alleviation (MoHUPA): MoHUPA is the apex authority of Government of India at the national level to formulate policies; sponsor and support programmes; coordinate the activities of various central ministries, state governments, and other nodal authorities; and monitor the programmes concerning all the issues of urban employment, poverty, and housing in the country.

The central ministries are followed by state departments concerning urban development, housing, transport, tourism, etc. The urban local bodies fall under the State Urban Development Departments. Besides this two-tier structure, numerous other actors within and around a city also have a role in planning for and facilitating adjustment to climate change (See Figure 1).

Figure 1: Stakeholders and entry points for climate change resilience planning



4. Mainstreaming Resilience Planning in Indian Cities

The World Summit on Sustainable Development in Johannesburg, 2002, highlighted the concept of integration of climate policy and the developmental planning process. In cognizance of the large-scale risks posed by climate change to cities, it is imperative that policy initiatives integrate or ‘mainstream’ resilience planning in urban development of the cities.

In India and across the world, Disaster Risk Reduction (DRR) has often taken a “reactive” approach of relief and rehabilitation soon after the occurrence of a calamity or disaster. Integration of disaster risk management along with developmental efforts offers an opportunity for better preparedness by taking a “proactive” approach towards DRR.

This section will discuss the various tools and methodologies that allow decision-makers and policy planners to mainstream resilience planning into the policy-making and planning process, which are the entry points for mainstreaming urban resilience within policies and programmes at the national, state, and city level, supplemented with examples from literature and from the three ACCCRN cities — Surat, Indore, and Gorakhpur. Having an integrated view towards climate resilience planning is essential, because in an urban environment, climate risks may only be one of the several factors defining poverty levels, well-being, economic growth, and development (Tanner et al., 2007).

Mainstreaming can be defined as the “integration of climate change related policies and measures into developmental planning process and decision-making” (Eriksen et al., 2005).

4.1 Responding to uncertainty and long time-scales

In recent years, responding to the impacts of climate change on the society, economy, and the environment at large has emerged as a defining challenge for policy-makers. This is particularly because of uncertainty in quantification of the regional impacts of climate change, as well as with regard to the time-scales over which some of these impacts are likely to be fully manifested and understood. For example, Sea Level Rise (SLR) is a gradual process unlike flash floods and cyclones, and regional SLR projections face several uncertainties.

In light of climate change, for an urban environment a new layer of uncertainty is added. An urban environment faces a number of uncertainties, primarily because of the rapidly changing variables such as socio-economic and demographic indicators, land-use patterns, resource demand and utilization patterns, lifestyle changes, policy and regulatory reforms, etc. Hence, policies that are directed towards building and enhancing resilience in the urban systems need to be able to capture this complexity and dynamicity to enable resilience in the long-term. A TERI study brings forth the concept of “Adaptive Policies”, i.e., “**policies that are designed to operate under complex, dynamic, and uncertain conditions**” (Swanson and Bhadwal, 2009). Given a specific context (depending on geographic scale, sector, issue, etc.), policies are crafted to respond effectively to a range of anticipated and unanticipated changes.

4.2 Entry points for mainstreaming resilience planning in urban India

Given the federal structure of policymaking and planning process in India, and existence of several agencies and stakeholders working on similar policy issues there can be *multiple entry points for mainstreaming resilience planning in India*. Within government plans and policies, the entry points are listed in Table 2.

Table 2: Entry points for mainstreaming resilience at various levels of government

National Level	Sub-national/State Level	City Level
National Missions as part of the National Action Plan on Climate Change Sectoral policies (water, transport, buildings, energy, etc.) Five Year Plans	State Agendas and Action Plans on Climate Change Sectoral policies State Five Year Plans	Master Plans City Development Plans Disaster Management and Resilience Plans City Mobility Plans City Sanitation Plans

There are also several international donor agencies and developmental aid organizations and national and international Non-Governmental Organizations (NGOs) and research institutes that can enable incorporation of resilience planning in their activities. This can be done by:

- Climate risk-screening of the programme portfolio
- Resilience planning for cities

4.2.1 National level

Mainstreaming resilience planning into urban development may happen within the ambit of current policies and programmes (climate proofing) and in some cases through new policies and programmes that support adaptation and mitigation actions in cities. India's National Action Plan on Climate Change (NAPCC) was released on 30 June 2008 and it outlines the national priorities for adaptation and mitigation research and policy strategies, through eight National Missions. The following Missions under the NAPCC offer direct and indirect opportunities for urban resilience planning.

National Action Plan on Climate Change

National Mission on Sustainable Habitats (NMSH)

- At the national level, the Mission recommends having a national urban policy that incorporates incentives and disincentives that encourage and support sustainable habitat. The mission document recommends that the state should prepare dynamic plans with provision for review every five years as proposed under the National Urban Housing Policy 2007.
- At the sub-national level, the Mission recommends that district/regional planning should take into account the specific impacts of climate change. Conservation and sustainable development of natural resources needs to be carried out this level.

- At the city level, the Mission recommends preparation of city Master Plans considering sustainable development norms, to be mandated for all cities. The Mission also recommends enforcement of Urban Development Plans Formulation and Implementation (UDPI) guidelines. Sustainable urban design should be achieved through zonal development plans/area specific plan, implementation, and enforcement of development control regulations and building bye-laws.

National Solar Mission

The National Solar Mission (NSM) aims to achieve an installed capacity of 20,000 MW by 2020. For cities across India, this is a huge opportunity to address energy security concerns while also contributing to mitigation efforts.

National Mission on Enhanced Energy Efficiency

This Mission mandates specific energy consumption decreases in large energy-consuming industries, with a system for companies to trade energy-savings certificates, energy incentives, including reduced taxes on energy-efficient appliances. In addition, demand-side management programmes in the commercial and domestic sectors are proposed.

National Water Mission

Specific action under the Mission as relevant for urban resilience include management of surface water resources, management and regulation of groundwater resources, upgradation of storage structures for fresh water, enhanced drainage systems for wastewater and conservation of wetlands.

National Mission for Green India

This Mission aims for the expansion of forest cover from 23–33% of the country's land, along with conservation of biodiversity. Several urban areas in India have the opportunity to promote urban forestry and maintain and/or increase urban green spaces both from a mitigation as well as adaptation perspective.

National Mission on Strategic Knowledge for Climate Change

The plan envisions a new Climate Science Research Fund, improved climate modelling, and increased international collaboration. It also encourages private sector initiatives to develop adaptation and mitigation technologies through venture capital funds. In the urban context, specific strategies that can support resilience include building a time-series database for specific climate and climate-dependent variables.

Other National Policies and Plans

In an urban environment, there may be very few strategies that exclusively address adaptation and/or mitigation; for example, seawalls for coastal protection. Hence, entry points within existing programmes that may contribute towards poverty reduction (decreases vulnerability) and enhancing overall well-being, need to be tapped. For example, Table 3 lists broad categories of action for different climate impacts of relevance to India (TERI, 2009b).

Table 3: Sectoral responses in various impact scenarios

IMPACTS OF CLIMATE CHANGE				
Sector	Drought	Flood	Sea Level Rise	Health Effects
Land Use Planning	Include water efficiency in building codes and infrastructure plans	Include flood protection in building codes, zoning	Prevent new construction in vulnerable areas	Promote healthy lifestyles with walking/ biking routes
Water Supply	Improve storage Reduce leakage Improve efficiency	Maintain quality Retain supply	Diversify sources Protect supply from saltwater intrusion	Improve potability and access
Sewerage	Adopt low water treatment options	Prevent overflow	Protect/relocate infrastructure	Improve coverage of sewage treatment
Storm Water Drainage	Harvest/store rainwater	Expand drainage capacity Improve natural catchments	Protect/relocate infrastructure Protect natural coastal defences in delta regions	Improve drainage Prevent standing water
Solid Waste	Improve organic waste re-use, for compost and moisture retention Encourage low water processes	Improve containment Prevent release	Protect/relocate infrastructure	Improve collection services
Roads/Traffic	Use pervious surfacing to allow for aquifer recharge	Improve road drainage Use pervious surfacing to encourage runoff Establish/improve evacuation routes	Protect/relocate infrastructure	Establish/improve evacuation routes and accessibility of health services
Housing	Improve water use efficiency	Promote flood-resistant designs	Prevent new development in vulnerable areas Relocate highly vulnerable settlements	Prevent overcrowding
Housing for the Poor	Increase efficient water provision	Prevent settlement and improve resilience in vulnerable areas	Prevent settlement and improve resilience in vulnerable areas	Increase housing provision and quality
Pollution	Prevent high ozone levels	Prevent release of water pollutants	Prevent ocean pollution from land contaminants	Decrease pollution
Education	Increase water conservation education	Improve disaster response education, early warning systems	Increase education about impacts and responses to SLR	Increase health education
Health	Prevent dehydration and related conditions	Prevent drowning and flood-related diseases Relocate and fortify key health infrastructure	Relocate health infrastructure	Expand and improve rapid response and preventive care

IMPACTS OF CLIMATE CHANGE				
Sector	Drought	Flood	Sea Level Rise	Health Effects
Recreation/ Open space	Employ water-efficient landscaping and maintenance techniques Encourage tree planting to reduce urban heat island	Increase water retention capacity in open space Manage flood-prone areas as green space to prevent settlement	Manage low-lying coastal areas as green space to prevent settlement	Promote healthy lifestyles
Governance	Strengthen capacity Improve transparency and inclusiveness	Strengthen capacity Improve transparency and inclusiveness	Strengthen capacity Improve transparency and inclusiveness	Strengthen capacity Improve transparency and inclusiveness
Finance	Improve financial resilience through efficiency measures	Flood-proof investments	Protect or reconsider investments	Ensure resilient health finances
Public Transport	Reduce water use for vehicle/system cleaning	Improve adaptive capacity of infrastructure Establish/improve evacuation routes	Protect/relocate infrastructure	Expand coverage and promote equal access to mobility options
Economic Development	Factor into commercial and industrial policy	Factor into commercial and industrial policy	Factor into commercial and industrial policy	Factor into commercial and industrial policy
Insurance	Protect against loss of livelihood	Protect citizens from loss of assets	Protect citizens from loss of assets	Expand access to healthcare for all citizens

Source: TERI (2009b).

As indicated in Table 2, climate change is a crosscutting issue that manifests its impacts at different spatial scales and across different sectors. Apart from the NAPCC, several sectoral policies address various dimensions of urban development and planning and offer entry points for mainstreaming resilience planning. These sectoral policies and programmes are discussed ahead.

Urban Infrastructure Development

The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) focuses on 65 selected cities over the period 2005–2012² and has the primary objective of creating economically productive, efficient, equitable, and responsive cities. JNNURM has two Sub-Missions/ components, as under:

- Sub-Mission I — Urban Infrastructure and Governance: It aims to encourage reforms and fast-track planned development of identified cities. The focus is on efficiency in urban infrastructure and service delivery mechanisms, community participation, and accountability of ULBs/Parastatal agencies towards citizens, preparation of City Development Plans, release, and leveraging of funds.
- Sub-Mission II — Basic Services to the Urban Poor: It focuses on ensuring the availability of the basic services to the urban poor and integrated development of slums through projects on providing shelter, basic services, and other related civic amenities.³

² JNNURM phase II will take forward the next stage of reforms for a period of five years

³ Retrieved from <http://jnnurm.nic.in/>, last accessed on 19 January 2010

The Urban Infrastructure Development Scheme for Small and Medium Towns aims at improving the urban infrastructure of towns and cities in a planned manner. It focuses on improving infrastructural facilities and creating public infrastructure and quality oriented services in cities and towns, enhancing public–private partnership for infrastructural development and promoting integrated development of towns and cities.⁴ The state government has the power to designate any existing institution as nodal agency for implementation of the scheme.⁵

Buildings

The Energy Conservation Act, 2001, established the Bureau of Energy Efficiency (BEE). The BEE co-ordinates with designated consumers, agencies and other organizations and recognizes, identifies, and utilizes the existing resources and infrastructure, in performing the functions assigned to it. The BEE has also formulated the Energy Conservation Building Code (ECBC) which is a voluntary code that provides the minimum requirements for energy efficient design and construction of buildings.

The solar buildings programme of the Ministry of New Renewable Energy (MNRE) is working towards expanding the use of dependable, cost-effective renewable energy in the buildings sector.⁶ In addition, building certifications like Green Rating for Integrated Habitat Assessment (GRIHA)⁷ and Leadership in Energy and Environmental Design (LEEDS)⁸ encourage green building construction.

Disaster management

Disaster management planning in India is positioned both at the central and state level with the help of institutions like national and state disaster management authorities. Following major disasters such as the Orissa super-cyclone (1999), the Gujarat earthquake (2001), and tsunami (2006), there were massive investments into relief and rehabilitation and proactive disaster risk reduction, leading to the constitution of the National Disaster Management Authority (NDMA) in 2005 (after the Disaster Management Bill of 2005 was passed) under the Ministry of Home Affairs (Revi, 2008). With this, disaster management in India shifted its focus to early warning systems and forecasting of extreme weather events. The NDMA enabled the involvement of the developmental sectors in disaster management and aided in the setting of Disaster Mitigation Funds and creation of the National Institute for Disaster Management (NIDM) that trained planners, trainers, communities for disaster risk reduction and management.

The BIS (Bureau of Indian Standards) developed the NBC (National Buildings Code) that was published in 1970 and revised in 1983. Thereafter three major amendments were issued, two in 1987 and the third in 1997. The NBC is a part of building bye-laws in many ways. It is a national code which gives guidelines for building construction in India and consists of regulations, rules, and general building requirements, such as fire safety requirements; stipulations regarding materials, structural design and construction; and building and plumbing services. It serves as a guiding code for municipalities and developmental authorities to formulate and adopt building bye-laws.

4 The Urban Development Minister Mr Kamal Nath stated that in the next phase of JnNURM, there would be enhanced focus on the Nagar Palikas and Nagar Panchayats i.e. on smaller towns and cities.

5 Retrieved from <http://www.cmao.nic.in/Resources/JNNURM/Guidelines/UIDSSMT-%20GUIDELINES.pdf>, last accessed on 29 January 2010

6 Retrieved from <http://www.nrel.gov/docs/fy99osti/24427.pdf>, last accessed on 15 January, 2010

7 A Green building design evaluation system for India, developed by TERI

8 A US certification for green buildings

Municipal Solid Waste Management

Management of municipal solid waste (MSW) is one of the major issues in Indian cities and towns. The problem is aggravated during floods and monsoons leading to clogged drains overflow of sewage and storm water, and outbreak of diseases. In addition, the landfill sites existing in India lack proper designing and hence there is an uncontrolled release of GHGs such as methane from waste dumps and landfills. At present, MSW Management and Handling Rules, 2000 apply to all municipal authorities responsible for collection, segregation, storage, transportation processing, and disposal of MSW. However, there is a need to revise these rules to factor in climatic considerations.

Transport

The objective of the National Urban Transport policy 2006 is to ensure safe, affordable, and sustainable mobility for the residents of cities. The policy emphasizes on integrated land use and transport planning, improving access to markets and commercial ventures, and equitable allocation of road space with a focus on commuters.

Urban housing

The national urban housing and habitat policy 2007 aims at ensuring equitable and affordable access to land and shelter to city residents. The policy emphasizes on coordination between diverse stakeholders including the private sector, cooperative and the industrial sector for labour housing, and services sector for employee housing.

4.2.2 State level

Following the NAPCC, states in India have been issued a directive from the centre to prepare their State Climate Change Action Plans (SAPCC). The first step towards preparation of a SAPCC is to identify state-specific risks and impacts and prioritize areas for research and policy action in response to current and future vulnerabilities and projected impacts of climate change. States of Delhi and Rajasthan are among the first to initiate the process by developing a State Climate Change Agenda that sets out the key risks and impacts of climate change on the state and accordingly lists priorities for research and policy action related to adaptation and mitigation. The State of Rajasthan combined the preparation of the Climate Change Agenda (CCA) along with the State Environment Policy. Orissa is the first state in India to have put forth a SAPCC. *These State Agendas and Action Plans provide a good example of, and an opportunity for integration of urban resilience at a sub-national level, within identified priority areas of the state.* Some key points are listed in Table 4.

A SAPCC lists institutional mechanisms and periods of operationalizing identified priority areas for the state. Similar to the structure of the NAPCC, the State Agendas and Action Plans also set out Missions (Task Forces in the case of Rajasthan) to address state needs in cognisance of the national priorities.

Table 4: State Action Plans on Climate Change

Delhi Agenda for Climate Change	Rajasthan Agenda for Climate Change	Orissa Climate Change Action Plan
<p>Sustainable Habitats Agenda</p> <ul style="list-style-type: none"> ■ Adoption of Green Building Codes for energy efficiency and standardization of construction materials. ■ Incorporation of BEE's ECBC into building plans of the local bodies. <p>Water Mission</p> <ul style="list-style-type: none"> ■ Increase water use efficiency and introduce decentralized waste water treatment <p>Green Mission</p> <ul style="list-style-type: none"> ■ Increase the green cover of city through an Eco Task force and Parks and Gardens Society <p>Solar Mission</p> <ul style="list-style-type: none"> ■ Mandates installation of solar water heating in various institutions to be supported by government subsidies. ■ Enhanced Energy Efficiency ■ Promotes use of CFLs and energy-efficient lighting systems in commercial buildings through incentives. 	<p>Urban Governance and Sustainable Habitats</p> <ul style="list-style-type: none"> ■ Better fuel quality to reduce GHG emissions; enhancing public transport with the gradual introduction of Bus and Mass Rapid Transit System ■ Promotion of green buildings, enforcement of ECBC. ■ Management of MSW, especially in tourist places along with capture of methane from landfills <p>Enhanced Energy Efficiency and Solar Energy</p> <ul style="list-style-type: none"> ■ Energy auditing of commercial and residential buildings ■ Developing 'solar cities' through promotion of solar energy utilization for street lighting, water heating and domestic lighting, and decentralized electrification using solar PV along with appropriate policy support. <p>Water Resources</p> <ul style="list-style-type: none"> ■ Rainwater harvesting to be mandated in all public buildings ■ Introduce standards for use of reclaimed wastewater for various purposes — irrigation, industrial use, etc. ■ Undertake water quality monitoring at intake, storage, and delivery levels along with upgradation of water drainage and storage capacities in cities. ■ Forestry and Biodiversity ■ Promotion of urban forestry in major urban centres 	<ul style="list-style-type: none"> ■ Build capacities in ULBs ■ Incorporate climate considerations in water supply and sewerage ■ Install water meters for water efficiency in cities ■ Capture methane emissions from landfills ■ Energy-efficient street lighting ■ Strengthening infrastructure for promoting non-motorized transport ■ Promoting water harvesting in urban areas ■ Developing models of urban storm water flows and capacities of existing drainage systems.

4.2.3 City level

Many cities have started planning for specific adaptation and mitigation strategies with a view to build long-term resilience to climate change impacts. Cape Town Framework for Adaptation Planning (2006), City of London's Strategy (2008), City of Keene's New Hampshire climate adaptation strategy, The Stockholm Plan (2007),

Plan NYC- New York (2007) are few examples where city governments have developed adaptation and mitigation strategies and plans bearing in mind, the long-term resilience of the city. ***In India, town planning is an important entry point for mainstreaming urban resilience.*** Review of several planning documents is required in order to identify options and strategies towards urban resilience. These include:

- Town and country planning act and zoning regulations
- Development control rules and building bye-laws
- District planning manual of the Planning Commission
- National building codes
- Urban Development Plan Formulation and Implementation (UDPFI) guidelines
- City master plans

At the city level, budgetary challenges and lack of fiscal autonomy still exist as bulk of the finances still rest with the Central and state governments and not with city governments.

4.2.4 Vulnerability assessment in ACCCRN cities

The vulnerability assessments have been conducted in three cities of India (Surat, Indore, and Gorakhpur). As part of the ACCCRN programme, these cities have already developed their resilience strategies. While in Gorakhpur, the vulnerability assessment was based on large-scale consultations, stakeholder perceptions, direct field observations, and primary and secondary data analysis; in Surat and Indore, the vulnerability assessments were captured based on the creation of specific indices through GIS-based sampling and aggregation and validated through stakeholder interactions. These indices related to education, socio-economic variables, and access to urban services and infrastructure, inter alia.

The Gorakhpur resilience strategy follows an integrated approach that addresses institutional, behavioural, social, and technical issues. The strategy emphasizes effective implementation of master plans while building in climate concerns into these plans that are statutory documents meant to guide the growth and development of a city. The strategy advocates utilizing targeted interventions that build knowledge, provide demonstrated examples to assist development, and build the capacity of organizations. The Surat and Indore Resilience Strategies are structured around four main principles: *(i)* build on current and planned initiatives; *(ii)* demonstrate resilience-building projects to leverage further action, multi-sectoral information generation, and shelf of projects; and *(iv)* build synergy with state- and national-level institutions. All these three cities acknowledge the need to mainstream resilience strategy into city development processes and to locate synergies at state and national level leveraging the required funds from here to carry on resilience-building strategies.

4.2.5 Climate risk screening

Another method of mainstreaming risk reduction and resilience planning is through climate risk screening. This climate risk screening process is also known as ORCHID (Opportunities and Risk from Climate Change and Disasters). It is an approach for reducing climatic risks to developmental objectives and integrating adaptation options within developmental programmes at the national and sub-national levels (Tanner et al., 2007). The steps involved in a climate risk screening include:

- Assessment of current and future impacts of climate change on developmental objectives of a project/policy;
- Assess the ways in which the developmental project/policy already contributes towards vulnerability reduction and risk reduction

- Identify potential entry points to integrate climate risk management strategies into the developmental project/policy ambit
- Prioritization of the selected strategies based on multiple established criteria
- Conducting cost-benefit analyses of the selected strategies.

4.2.6 Examples of Climate Risk Screening

This approach was applied to the Urban Service for the Poor programme of DFID-India in two states of India — West Bengal and Madhya Pradesh. The Kolkata Urban Services for the Poor (KUSP) and Madhya Pradesh Urban Services for the Poor (MPUSP) strengthen governance at the level of the state and urban local bodies. They also support infrastructure improvements to ensure affordability of and access to basic services by the poor. The *climate risks* to the objectives of KUSP and MPUSP were identified as water logging and flooding due to an increase in high precipitation events, consequently impacting urban drainage, waste management, water supply and sanitation, and community health services. The existing measures being addressed within the programme portfolio and additional opportunities for managing future climate risks are highlighted in Table 5.

Table 5: Climate Risk Screening Conducted for Urban Services for the Poor Programmes in India

Identified climate risks	Climate Risk Management (CRM) and adaptation		
	Current practices		Additional opportunities for CRM and adaptation
	KUSP	MPUSP	
Urban flooding	In- situ slum upgradation		<ul style="list-style-type: none"> ■ Strengthening O and M activities with periodic monitoring and evaluation ■ Comprehensive urban planning considering climatic risks (includes construction of adequate drainage channels)
Health risks due to contamination of water supplies	O&M of existing water supplies and drainage systems	Enabling ULBs to develop and follow environmental standards for sanitation and drinking water	<ul style="list-style-type: none"> ■ Development of a spatial and temporal database for water quality surveillance ■ Raising plinth level of toilets ■ Better insulation of toilet pits to reduce seepage into the soil and groundwater

Source: (TERI, 2007, Chapter 3)

5. Way Forward

The concept of resilience finds its roots in ecological sciences hence its applicability to social sciences field finds different interpretations.

Given the number of cities in India, out of which about 50 are million plus cities, there is a need to act fast towards building resilience within the Indian cities. To achieve the same, there is a need to build capacity of urban centres to measure their vulnerabilities and develop their own resilience plan. Some steps have been highlighted in Figure 2.

Some of the tools and methodologies available to address risks, vulnerabilities, and resilience in an urban context are limited to a conceptual understanding level with very few examples of practical application. Hence, it is essential that these tools and methodologies are supplemented with a review of existing policies and pro-

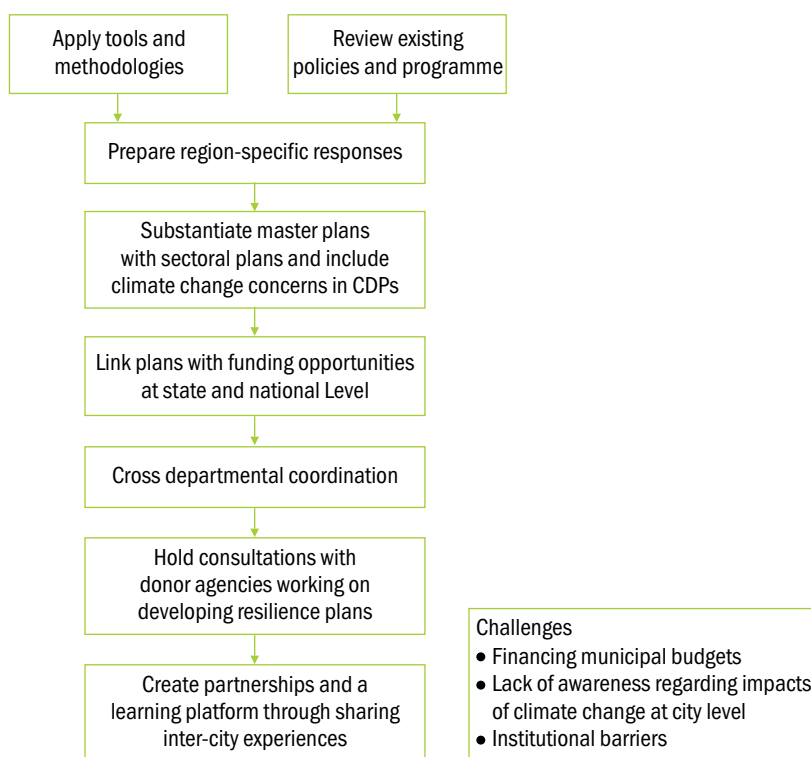
grammes to develop responses best suited to a region/community. Master plans are essentially land-use plans in India. These should be substantiated with sectoral plans so that each sectors' development is in synergy with other and integrated development could be achieved. The Town Country and Planning Organisation (TCPO) is now promoting regional development planning to be decentralized at the micro-zonation levels. However, at this stage there is a great need for capacity building of TCPO officials to take this forward so that the cities take up all the functions delegated to them under the 74th Amendment Act.

Besides looking at the synergies with the existing policy legislative framework at place in India, it is also essential to look for practical ways for cross-departmental cooperation, linking plans with funding opportunities at state and national level, and ensure a broad based political support for implementation of the resilience strategies. The CDPs⁹ prepared under the JNNURM are not linked with the Detailed Project Reports (DPRs)¹⁰; hence, there exists a gap between planning and implementation efforts. However, CDPs could be a channel to bring in environmental and climate change concerns into city-level planning mechanism. Many donor agencies are currently working on pilot modes in specific regions and sectors and are seeking government support to scale up their activities and replicate success stories. However, there is a lack of a coordinating authority to bring to-

As part of the ACCCRN study, a half-day roundtable on 'Exploring Partnerships' was conducted on 27 October 2010 to get insights into the priorities of different donor agencies working in the area of urban development and resilience in India. During the roundtable discussions, various donor representatives presented on how resilience currently features in their urban development portfolio, and plans for upscaling current efforts or starting new initiatives.

A policy roundtable on 'Sharing Knowledge and Scaling Up Action on Urban Resilience in India' was held on 10 March 2011. It was discussed that there is a need to upscale the activities carried out under ACCCRN programme to other cities as well. This programme takes into consideration various sectors and their overlaps while planning for resilience. It was discussed that there is a need to link resilience planning exercise and resilience strategy development at a city level.

Figure 2: Steps to develop city-wise strategy



9 Each ULB that is seeking assistance from the JNNURM is required to prepare a City Development Plan that shall include strategy to implement reforms, city-level improvements and an investment plan to address the infrastructure needs in a sustainable manner.

10 Projects that apply for funding under the JnNURM programme are required to prepare and submit a Detailed Project Report (DPR).

gether these diverse groups. ACCCRN aims to bring in more stakeholders and create an independent learning platform.

Communicating experiences amongst cities is an essential and effective way to initiate adaptation actions within cities and to enable sharing of best practices.

There are also some key challenges in institutionalizing climate adaptation and mitigation in an overall resilience framework. A major focus needs to be on awareness generation, capacity building, and training of city level officials to understand climate risks for their city. The vertical linkages, i.e., from city level to the national level and horizontal linkages i.e. between municipalities and ULBs at the city level need to be strengthened to address institutional barriers to the implementation of selected adaptation and mitigation strategies.

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