Chapter 3
Urban Informality and Planning: Challenges to Mainstreaming Resilience in Indian Cities

Minal Pathak and Darshini Mahadevia

3.1 Introduction

The merits of aligning climate change and sustainable development actions in cities are now well accepted with a large body of scientific literature in the past decade and corroborated in IPCC's fifth assessment report (IPCC 2014a). Urban resilience has emerged on the forefront of the urban development agenda globally, more so with the UN Sustainable Development Goals (goals 11 and 13) that exhort urgency to address climate change and its impacts and to make cities inclusive, safe, resilient and sustainable (United Nations 2015). This has now opened up the discussion around the necessary urban planning and policy interventions to achieve this.

As a large developing country, India is experiencing multiple transitions. Amidst increasing trends in population growth, economic growth and urbanization, addressing simultaneous goals of sustainable development and climate change is a daunting task. Synergistic actions would open up the possibilities to exploit the window of opportunity and deliver multiple co-benefits (Shukla et al. 2015). This is well recognized and reflected in India's commitment to sustainability based approach for addressing climate change. For instance, India's National Action Plan on Climate Change (GoI 2008), implemented in a 'missions' mode identifies eight submissions that align climate change actions with sustainable development. Within these, the National Mission on Sustainable Habitat outlines key actions in urban areas to develop climate compatible urban centres that enhance quality of life. Earlier studies demonstrate the possibilities for achieving low carbon sustainable

M. Pathak (✉)
Global Centre for Environment and Energy, Ahmedabad University,
Navrangpura 380009, Ahmedabad, India
e-mail: minalpathak01@gmail.com; minal.pathak@ahduni.edu.in

D. Mahadevia
Faculty of Planning and Centre for Urban Equity, CEPT University,
Navrangpura 380009, Ahmedabad, India

development in Indian cities through sectoral mitigation and adaptation actions
(Puppim De Oliveira et al. 2013; Pathak and Shukla 2016).

Indian cities are developing sustainability plans. However, as evidence from
global cities shows, stand-alone plans lack the integration necessary for a net-
worked approach to planning that may be necessary to address future risks
(Childers et al. 2015). It is well accepted that conceptualizing urban resilience
should go beyond the classical definitions of post-disaster recovery and integrate
sustainability over spatial and temporal dimensions (Sharifi et al. 2017). The paper
does not delve into new conceptualization of resilience. Instead, we adopt the
definition of the Intergovernmental Panel on Climate Change (IPCC) where
'Resilience is the capacity of social, economic and environmental systems to cope
with a hazardous event or trend or disturbance, responding or reorganizing in ways
that maintain their essential function, identity and structure, while also maintaining
the capacity for adaptation, learning and transformation' (IPCC 2014b, c).
Therefore, resilience would mean response to and recovery of urban systems and
people in response to climate related extreme events.

Mainstreaming information on climate risks, policies and interventions in
existing decision-making has been proposed as a way for more sustainable and
efficient decision making compared to designing and managing climate policies
separately from ongoing activities (Ayers et al. 2014). For Indian cities, building in
climate change resilience actions could possibly involve higher costs in the short
term relative to addressing only the immediate goals of providing shelter, basic
services and local economic development. At the same time, addressing these
immediate goals will support climate change resilience actions.

The architecture of urban planning and governance in India are both enabling
and challenging to resilience building. An additional complexity is the nature of
urbanization in India which is largely informal (Roy 2009). With 102.4 million (or
26.4%) urban population living below the poverty line of INR 1407 (USD 29.38)
per capita per month in 2011–12 (GoI 2014), continued poverty has posed a chronic
and persistent challenge to policymakers addressing urban sustainability.

Within this context of dynamic urbanization and informality, resilience includes
the capacity of the urban poor to respond to and cope with climate change events. In
the second and third sections (Sects. 3.2 and 3.3), the chapter looks at how urban
governance and planning influence resilience management for Indian cities. Using
the case study of Ahmedabad city's Heat Action Plan, the paper highlights the key
challenges to mainstreaming to climate resilience in Indian cities.

3.2 Urban Planning

India is currently at a low level of urbanization; according to the most recent
population census, 32.7% (377 million) population lived in urban areas in 2011.
The population is unevenly distributed across different size classes of cities and
towns. Forty-three per cent of the urban population resided in the metropolitan

cities (million plus cities) in 2011, while about 38% lived in towns and cities below 200,000 population in 2011, (Mahadevia and Sarkar 2012). In the decade between 2001 and 2011, the urban population shifted towards metropolitan cities while the small towns registered a steep decline in population growth. By 2050, over half of India's population will live in urban areas (United Nations 2014). Based on the current trends, the challenges of achieving urban climate resilience will also play out differently due to India's unequal urbanization pattern, with a possibility of the large and metropolitan cities attracting more attention compared to their small and medium sized counterparts.

Urban development falls under the purview of the state government. Urban development, as defined here, includes land use planning through statutory Master Plan or Development Plan; Comprehensive Mobility Plan, Infrastructure Investment Plan, Environmental Protection Plan and Housing Strategies. Of these, the preparation of Master Plan or Development Plan[1] is statutory. In some cases, sectoral (transportation, infrastructure, environmental protection and housing) plans form a part of the Master/Development Plan. At the state level, town planning and/or urban development legislation specifies the approach to land acquisition and development for urban use, zoning, and road layouts. Zoning decides activity locations and road layouts broadly indicate the direction of development of the city.

At the next level below the Master/Development Plan are the smaller area plans, referred as zonal plans/district plans/town planning schemes. Each of these plans has a different mechanism of deciding on land use allocation and layout of the roads. In some states at the third level are the local area plans, which also include three dimensional designs of spaces. The different urban planning components, the scale at which these need to be planned, elements or measures of building resilience and institutions/ actors involved for the building resilience required in the Indian city contexts are presented in Fig. 3.1 and detailed in Table 3.1. This table also identifies the existing state/local policies or programmes in which these resilience measures could be dovetailed.

3.3 Urban Governance Structure as It Relates to Urban Resilience Planning

Revi et al. (2014) recognize governance as an important element for climate adaptation and resilience and emphasize importance of multilevel risk and multi-scalar governance frameworks for addressing these. Table 3.1 mentions scales of interventions and the existing institutional entities responsible for planning and implementation.

---

[1]In some states such as Gujarat the term Development Plan is used while Delhi uses the term Master Plan.

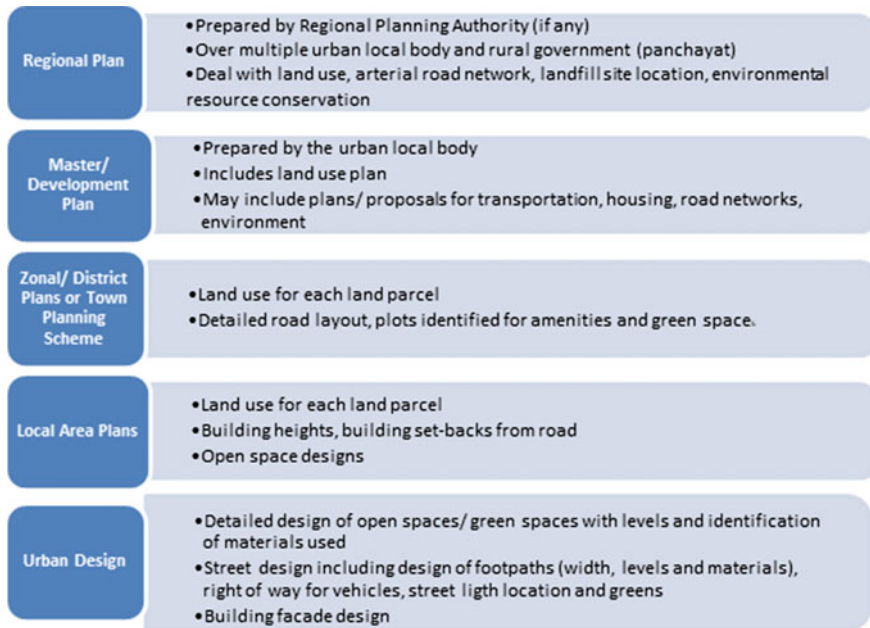| Regional Plan	• Prepared by Regional Planning Authority (if any) • Over multiple urban local body and rural government (panchayat) • Deal with land use, arterial road network, landfill site location, environmental resource conservation
Master/ Development Plan	• Prepared by the urban local body • Includes land use plan • May include plans/ proposals for transportation, housing, road networks, environment
Zonal/ District Plans or Town Planning Scheme	• Land use for each land parcel • Detailed road layout, plots identified for amenities and green space.
Local Area Plans	• Land use for each land parcel • Building heights, building set-backs from road • Open space designs
Urban Design	• Detailed design of open spaces/ green spaces with levels and identification of materials used • Street design including design of footpaths (width, levels and materials), right of way for vehicles, street ligth location and greens • Building facade design

Fig. 3.1 Urban Planning Hierarchy, Ahmedabad

In India, city boundaries are defined by the state government. This is problematic-when a city's growth spills over as 'Outgrowth' but the formal boundary of the Urban Local Body (ULB) remains unchanged. This development pattern led to creation of a separate entity called the urban development authority (UDA), to address physical developments of the city beyond the local government's jurisdictional limits. To put it simply, the UDAs plan and implement projects in the urban sprawl areas. Such a pattern is more commonly observed in case of metropolitan and some large cities (population between half a million to 1 million). The UDAs are engaged in technocratic duties of planning and implementing capital works and land development. With city management being solely their responsibility, ULBs are directly accountable to citizens. Consequently, these authorities are heavily burdened with administration, service delivery and emergency response to disasters. The UDAs are not elected therefore they are not directly accountable to citizens. Their relationship with the ULB depends largely on the powers ascribed to them. In some cities, the UDAs are more powerful than the ULBs and have powers to prepare urban development plans, city transportation plan and city infrastructure plan.

The State governments have the powers to sanction various plans-Master/ Development Plans and other lower level plans. The state governments also hold the powers over legislation. As a result, ULBs are burdened with managing routine urban matters without having independent sources of finance. The problem is particularly severe in smaller cities where the financial and functional capabilities

Table 3.1 Urban Planning and Governance Frame for Resilience-building Measures for India

Elements	Planning scale	Programmes/schemes/legislation	Entities (to be) involved	Elements/measures of resilience building
Urban built-form				
Land use plan	• Municipal government • Regional as defined by regional development authority	• State town planning and/or urban development Acts • AMRUT for waste management	• Municipal government • Regional development authority • Village Panchayats • State urban development department • Central government, Ministry of urban development • Hawkers' union	• Densities, Floor-space index, Dwelling Unit (DU) size • Zoning • Restricting developments in risk-prone areas • Landfill siting Green spaces demarcation • Street design
Urban design	• Local area/ward • Street • Neighbourhood • Community	• None	• Municipal government (ULB) • Ward committee • Area/neighbourhood/community associations • Non-governmental organisations	• Ward or neighbourhood level • Street design • Building design • Water harvesting/disposal designs, i.e. local channels, recharge pits, soft surfaces, etc. • Green space design
Transport				
Transport plan	• Municipal government (ULB) • Region (in case of metro cities)	• E-mobility mission • AMRUT	• Unified metropolitan transport authority (UMTA) if any • Mode-specific authority, i.e. Delhi metro rail corporation, Indian railways for sub-urban trains, public transport corporations • Auto-rickshaw or e-rickshaw unions	• Climate responsive mobility plan (i.e. for heat impacts, flood impacts, storm impacts • Public transport plan
Water supply, sewerage, solid waste management				
Infrastructure plan	• Municipal government (ULB) • Region	• AMRUT • Capital projects in the domain	• Municipal government (ULB) • Regional development authority • Village Panchayats • State urban development department • Central government, Ministry of urban development	• Water supply network • Water availability augmentation plan in dry regions • Sewerage network • Storm water drainage network

(continued)

Table 3.1 (continued)

Elements	Planning scale	Programmes/schemes/legislation	Entities (to be) involved	Elements/measures of resilience building
		• Swachchh Bharat mission (Clean India Mission)		• Bunding/dikes along coast/waterways • Solid waste management plan • Waste (hazardous & non-hazardous) disposal plan
Energy				
Energy supply	• Municipal government (ULB) • Region • Sub-municipal/ward • Neighbourhood	• National Solar mission • Waste to Energy Mission	• Ministry of New & Renewable Energy, central government • State government	• Energy plan • Decentralized municipal energy Solar PV Municipal Waste to energy
Environment and pollution				
Environment plan	• Municipal government (ULB) • Region • Sub-municipal/ward • Neighbourhood	• AMRUT • Environmental legislation	• State government department of environment • Municipal government (ULB) • Ward committees • Neighbourhood committees/associations • Community-based associations	• Pollution control plan • Non-development zone • Green area development plan • Rain Water harvesting • Water ways (rivers, canals, lakes & ponds) development plan • Wetlands development and conservation • Ground water management
Housing				
Housing plan	• Municipal government (ULB) • Region • Sub-municipal/ward • Neighbourhood	• Housing for All (PMAY)	• Municipal government (ULB) • State level housing & slum boards/authorities • Regional planning authority, i.e. AUDA • Revenue department of the state government • Non-governmental organisations	• Individual house/building level water storage • Individual house/building level toilets • Slum redevelopment plan

Source Authors

are much lower, limiting the local government's ability to respond to any emergencies, and almost negligible capacity for resilience building. This centralisation of urban governance at the state government level and lack of financial powers severely constrain ULBs (Mathur 2013; Sivaramakrishnan 2013). Even in the case of metropolitan cities, the governance is highly fractured and fragmented (Sivaramakrishnan 2014) and city governments largely dependent on the state governments. Mahadevia (2010b) has argued that the earlier autonomy of the municipal governments has eroded over time due to various reasons such as requirements for large investments that make the cities dependent on the state government, interest of the state-level politicians, including the Chief Minister of the state to project the state's important city's development through branding to attract investments (Mahadevia 2011a), financial resource dependency for capital projects and above all political interference of the state level politicians.

Another area under control of the state government is the implementation of infrastructure projects. The state governments have greater interests in their capital and large cities and hence they tend to neglect the small and medium towns (for infrastructure levels in small and medium towns vs metropolitan cities see Mahadevia and Sarkar 2012). The State Level Nodal Agencies (SLNAs) and agencies created for the implementation of the national level programmes, for example, the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) further eroded the powers of the ULBs.

Most urban public transport authorities either belong to the state government or are parastatals controlled by the state government. Barring a few cities such as Ahmedabad and Mumbai, ULBs do not have control over them. State agencies also address environmental issues including pollution control, waste management and parks and green cover. Managing water bodies could be controlled by the state government or the local government depending on the jurisdiction.

In summary, the governance structure for implementing plans and projects for urban resilience building is fragmented with jurisdiction of multiple agencies at two levels-local and state government. The municipal government lacks authority to coordinate the activities for a climate resilience plan. The participation of the community and neighbourhoods is feasible only if the municipal government is the main coordinating authority for various necessary climate change resilience actions. That not being the case, community and neighbourhood associations, and NGOs continue to work in their isolated terrains limiting the possibility to scale up good practices.

3.4 Urban Poverty, Informality and Resilience

The previous sections discuss at length the elements of urban planning and urban governance as these influence climate resilience planning. In this section, we discuss poverty and informalisation as the third most significant dimension to mainstreaming urban resilience. Methodology for estimating poverty have changed

periodically in India (Mahadevia and Sarkar 2012; GoI 2014) making it difficult to assess the changes in incidence of poverty as well as the total numbers below the poverty line.

Urban poor reside in informal settlements, which generally are illegal. Hence, ULBs do not invest in basic services in these settlements. Residents in these areas lack access to piped water supply, sewerage and storm water drains, paved streets and green spaces. Lack of piped water supply increases the residents' vulnerability to impacts from heatwaves, droughts and floods. Inadequate and poor quality of sewerage and storm water drainage imposes huge risks during floods and storm surges. Unpaved streets are prone to waterlogging during monsoon posing severe health risks from unhygienic conditions such as epidemic outbreaks from the waste mixing with rainwater.

With already low levels of nutrition any post disaster epidemic afflicts the poor the most and cause severe impacts and in several cases even mortality. Within this segment, the children, women and elderly are the most vulnerable. Climate change impacts aggravate poverty as the poor who are the most vulnerable suffer higher damages and get further pushed below the poverty line. The poor households and communities face development constraints including financial and social capital deficits which increase their vulnerability to extreme events. Poverty reduction can support adaptation by increasing individual, household and community resilience for building climate change resilience (Revi et al. 2014).

Land tenure is an important determinant to improving infrastructure and housing conditions in the informal settlements. This is particularly challenging to resolve and has been a long standing impediment to upgrading programmes (Boonyabancha 2005, 2009); (Mahadevia 2010a, b) essential for local-level adaptation action. Further, tenants also are not included in slum upgrading programmes. Thirty per cent of urban households live on rent (National Sample Survey Organization 2010), including in the informal settlements (Desai and Mahadevia 2014). "Tenants and those with the least secure tenure are often among the most vulnerable and exposed to hazards but also are usually unwilling to invest in improving the housing they live in and less willing to invest in community initiatives" (Revi et al. 2014 p. 581).

Informal settlements have largely developed on the urban periphery, without obtaining legal permissions related to land use conversion from agriculture to non-agriculture or non-compliance with the city's Master/Development Plan or the other plans below the city level plan. At the planning stage, large parts tend to be categorised as illegal as these do not conform to the planned use, the Development Control Regulations (DCRs) or building codes. The high cost of conforming to the legal provisions prices out the low-income households from the urban housing markets. There is a historically accumulated housing deficit of 18.8 million houses (NBO 2012). While housing programmes to support low-income households have been in operation, meeting the housing deficit through public housing programmes would be a long term process.

There are no official estimates of informal housing. Calculating from the National Sample Survey data, 67%, or two in every three households in the bottom 40

expenditure percentile of the urban population live in informal housing categorised as independent units (National Sample Survey Organization 2010 p. 67). These independent units could be in slums or informal settlements. To get some broad ideas of numbers; 31.5 million urban households comprised of bottom 40% in 2011, of which 21.1 million lived in informal housing. Hence, the tasks of formalising land tenure in urban India are stupendous. Legalisation of an informal settlement is feasible if the land belongs to the local government or the state government and land rights can be granted to the residents. Land rights cannot be granted without formal legislation, which is absent in many states. More often than not, this option is not chosen by the local government as the finance-strapped governments prefer to auction such lands to generate funds for capital projects (Mahadevia 2010a, b). The large proportion of informal housing is on privately owned lands, making it difficult for local governments or state government to acquire them for formalising tenure of the resident households. Informal tenure then continues to prevail for long periods.

These communities also face the continuous threat of eviction from the governments when lands they are occupying are to be used for more profitable uses, or for city beautification projects or large city level infrastructure projects. It is within these informal settlements that much of the disaster risk is concentrated; thus vulnerabilities and risks faced by the urban poor living in these settlements aggravates during disasters thereby, exacerbating their already precarious living conditions and creating a vicious circle of poverty. Thus, the poor disproportionately bear the brunt owing to their limited capacities to cope with the disasters and their aftermaths (Wamsler 2008; Baker 2011; Satterthwaite 2011).

Urban land markets work such that the poor tend to occupy the most marginal lands such as riverbanks, marshes, railway tracks and hill slopes. Due to the hazardous or ecologically sensitive locations, these slums do not get regularized and hence are deprived of basic services, increasing their vulnerability. The poor convert some of the marginal lands, such as marshy or low-lying habitable by refilling. Such lands attract the attention of land developers or the local government, depending upon whether the lands are private or public leading to a series of episodes of displacement. Private land developers are well aware of the possibility of speculative profits from land and are in a position to influence local policy-making, resulting in slum demolitions. If offered, rehabilitation post demolitions tends to be in urban periphery (Mahadevia et al. 2014; Coelho and Raman 2013). In Chennai, Coelho and Raman have observed that once evicted from the fragile locations, slum dwellers are sent on rehabilitation sites, which are often equally fragile lands such as floodplains or lakebeds. If no rehabilitation is offered, the poor tend to squat in new locations, often in the urban periphery (Doshi 2013).

In summary, the urban poor live in vulnerable housing conditions, vulnerable from all aspects, tenure security, health conditions and climate change. Without access to basic infrastructure, this population is the least resilient. This segment is also less able to influence development plans and public expenditures while the wealthier sections of the populations are the main beneficiaries of public expenditures. The section highlights the issues of informality in Indian cities and argues

that resilience plans must incorporate this element if the true goal of building equitable, resilient and sustainable urban habitats is to be achieved.

3.5 Case Study: Ahmedabad Heat Action Plan

As the concept of resilience continues to gain ground globally, Indian cities are increasingly recognizing the need for resilience building. Presently, these plans are limited to piecemeal measures to address specific risks and remain disjointed from the existing urban development plans. As part of the ACCCRN Resilient Cities initiative supported by Rockefeller Foundation, the city of Surat has developed a comprehensive Resilience Strategy. A large number of Indian cities, especially small and medium sized cities lack adequate financial and institutional capacity to assess, comprehend and act on specific climate risks. This section discusses the Ahmedabad Heat Action Plan, which is a first of its kind attempt to address a specific climate risk (heatwaves and urban heat island) for an Indian city. The analysis could draw out lessons that could be useful for enhancing or building resilience plans for other Indian cities.

3.5.1 About Ahmedabad

Ahmedabad city is located in western India and has a population of 6.5 million (2011). It is the seventh largest city in the country and the second biggest trade center of western India (Fig. 3.2). It is also the commercial capital and plays a significant role in the economy of the state of Gujarat. Ahmedabad is also a major financial centre contributing about 14% of the total investments in stock exchanges in India. The economic base of the city is now shifting towards tertiary (service) sectors, which now account for more than 50% of total employment. Ahmedabad is among the top 20 cities to be developed as smart cities under India's Smart City Mission launched in 2015 (GoI 2015).

The city had high population growth rate in 2001–11 (3.1% per annum) compared to the national average (2.5%). Presently, the city covers 466 km^2 and falls under the Ahmedabad Municipal Corporation (AMC) (Mahadevia et al. 2014). Beyond this, the area falls under the jurisdiction of the Ahmedabad Urban Development Authority (AUDA) which prepares and implements the physical plan of the area including town planning schemes, regulating development activities and laying down infrastructure. AUDA controls about 1866 km^2 and activities within this zone are regulated by the Urban Development Plan of Ahmedabad, a statutory plan for 20 years[2].

---

[2]AUDA. (2013). *Comprehensive Development Plan 2021 (Second Revised Part-1)—Exiting Conditions, Study and Analysis, AUDA, Ahmedabad.* Ahmedabad: AUDA.

3.5.2 Existing Vulnerability and Climate Change Risks in Future

As a rapidly growing megapolis, Ahmedabad faces unique sustainability issues. On one hand, significant investments have been made on showcasing mega projects to enhance the image of the city such as the mass transit[3], a large scale Riverfront Development project, and several lakefront revitalization projects. Conversely, rapid population growth resulted in huge demand for infrastructure and land for residential and commercial spaces. Meeting this demand was at the cost of urban sprawl, reduced green spaces and infrastructure deficit. A large proportion of population in the city lives in informal housing with poor quality of infrastructure. In 2011, 14.3% of the population lived in slums while the unofficial number was over 30% (Mahadevia et al. 2014).

Ahmedabad falls in the semi-arid zone and has hot and dry climate with average summer temperatures reaching 38 °C. The population in the region is at high risk from heat waves, particularly the urban poor residing in informal housing with inadequate infrastructure access. A large segment of this population is employed in informal sector such as street vending, and small businesses requiring them to spend a large part of their day outdoors which increases their vulnerability to heat waves. Future projections for Ahmedabad show a significant increase in the number of hot days with temperature increase over 40 °C. Modelling for the impacts of temperature on mortality Ahmedabad displays a "J" shaped relationship with the rate of mortality projected to increase markedly beyond the threshold summer temperature of 32.2 °C (Dholakia et al. 2014).

The Ahmedabad Urban Development Plan recognizes the increasing urban heat island effect in the city and indicates adopting measures to reduce the impact and enhance resilience to heat waves. These include, among others, measures to reduce dust emissions, improve green cover, and increase permeable surfaces. The plan also specifies incentives to land owners to encourage development of hard and soft surfaces and creation of a citywide network of green streets, parks and open spaces.

Urban resilience is also an integral component of Ahmedabad's proposal submitted as part of India's smart city mission. The resilience component includes i. Climate resilience ii. Disaster planning including floods, droughts, epidemics and iii. Heat Action plan. Table 3.2 outlines Ahmedabad's resilience actions outlined in different plans.

---

[3]Since 2008, the city has made sizeable investments in new transport systems including the 97 km BRTS network and two metro corridors spanning 36 km, the first phase of which will become operational in 2018.

Fig. 3.2 Ahmedabad in India

3.5.3   Ahmedabad Heat Action Plan

In 2010, Ahmedabad experienced a severe heatwave with temperature reaching
46.8 °C accompanied by a substantial increase in mortality (Azhar et al. 2014). The
event drew the attention of policy makers to the urgency of the issue. Subsequently,
collaboration between the local government and national and global research
organizations was formed to prepare local response strategies. A series of consul-
tations and research studies were carried out to identify vulnerable populations,
measures to build individual and community resilience, and improving heat-disaster

response planning in the city. The Ahmedabad Heat Action Plan was formally announced in 2013. The plan identifies four key strategies: i. Building Public Awareness and Community Outreach ii. Utilizing an Early Warning System and Inter-Agency Coordination iii. Capacity Building Among Health Care Professionals Reducing Heat Exposure and iv. Promoting Adaptive Measures. A nodal officer was appointed to oversee implementation of the plan and ensure inter agency coordination in the event of a heat wave[4]. The strategies and response actions had a specific focus on including the most vulnerable groups.

AMC initiated implementation of the plan involving state government departments, local government agencies, NGOs, health department, water supply authorities and institutional groups. Policy briefs were issued with special focus on strategies for workers in high risk occupations, communities in slums and women. To prepare for the heat wave, the city issued colour coded alerts through print and electronic media to warn stakeholders including service providers and citizens. Shelters were opened up to serve as relief centres. The messages were disseminated through various means including pamphlets in regional languages, advertisements, public messages, and community outreach programs. The AMC has invested over $100,000 towards implementation including the early warning system[5]. Preliminary evaluations show positive outcomes in terms of reduced health mortality.

The Ahmedabad Heat Action plan is a pioneering initiative at the subnational level. Through this partnership between the project team and the AMC, Ahmedabad leads as the first Indian city to create a comprehensive early warning system and preparedness plan for extreme heat events. The strong leadership of the local government, effective communication and innovative strategies backed by a robust institutional structure enabled efficient delivery of the plan. The engagement of stakeholders at early stages of the process also contributed to its timely and effective execution.

Success of the plan has led to its replication in other cities in India. In 2017, over a dozen cities and states had adopted or developed heat action plans. The plan has a strong element of coordination across various governance levels. It contributes to the State's mission to implement climate compatible strategies and has catalysed the development of new national guidelines and improved heat forecast systems covering over 300 cities (NRDC 2017). The guidelines issued by India's National Disaster Management Authority encourage state and city authorities to formulate heat action plans following the example of Ahmedabad.

While the plan has succeeded in implementation, the existing strategies largely focus on preventive measures that address short-term and immediate impacts of heat waves; it does not include long term measures to build in climate resilience.

---

[4]For example, in April 2013, a simulation exercise was organised with 50 city officials, key stakeholders and international experts to plan how their agencies would react to a heat wave and to improve inter-agency communication in the city.

[5]https://cdkn.org/project/climate-change-addressing-heat-health-vulnerability-in-rapidly-urbanising-regions-of-western-india/?loclang=en_gb. Accessed 27 July, 2017.

Table 3.2 Resilience elements in existing plans of Ahmedabad

Existing plan/ proposal	Key elements	Institution
Proposal for Smart City Mission	i. Climate resilience ii. Disaster planning including floods, droughts, epidemics and iii. Heat Action plan	Ahmedabad Municipal Corporation
Heat Action Plan	i. Building Public Awareness and Community Outreach ii. Utilizing an Early Warning System and Inter-Agency Coordination iii. Capacity Building Among Health Care Professionals iv. Reducing Heat Exposure and Promoting Adaptive Measures	Ahmedabad Municipal Corporation in partnership with local and global research institutions
Ahmedabad Urban Development Plan	i. Identifies heat effect due to hard and reflective surfaces. ii. Reduce dust pollutants that capture and contain heat iii. Green cover, permeable pavements iv. Incentives to land owners for soft surfaces v. Monitoring of Heat Action Plan	Ahmedabad Urban Development Authority

For instance, the heat action plan does not integrate planning interventions such as increasing green cover and managing water bodies despite these being a part of the city development plan. Additionally, while different plans recognize the importance of resilience building (Table 3.1), these remain fragmented. For instance, in the case of Ahmedabad, the heat action plan of the city should have been linked to the green spaces demarcation, solid waste management plan and urban design proposals in the city's Development Plan. In recent years, the city has implemented water supply and lake restoration projects. These proposals have sizeable opportunity to enhance resilience building, however, due to the limited scope of the Ahmedabad Heat Action plan, the opportunity to embed heat resilience into the urban planning mechanism has not been fully exploited.

Some reasons for fragmented planning include the existence of multiple planning agencies, weak coordination among these and lack of integration among sectoral plans. Political constraints to long-term resilience actions are mainly resulting from the disconnect between the long-term nature of resilience planning with short term political cycles. The absence of communication between policymakers, planners and stakeholders is another challenge. In addition, vertical coordination among national targets and local level plans is weak. Even with strong city development plans, several planning elements do not get translated into local area plans.

As mentioned in earlier sections, the presence of a sizeable population living in informal settlements is a major challenge. However, a successful and equitable resilience plan should focus on providing housing and infrastructure for the urban poor. Ensuring long term resilience will require a coherent vision and integration across plans. As observed by Mahlkow and Donner (2016), the Ahmedabad study also highlights that mainstreaming of a resilience plan into the urban development plan requires coordination across government agencies at different levels and linkages between formal and informal planning and governance instruments. Resilience building will also require continuous stakeholder inputs from the planning and implementation to the post implementation feedback. The implementing authority in turn should continuously engage with different stakeholders before, during and post implementation. Such an engagement would ensure long-term sustainability of the initiatives and promote equity through participation of different groups.

3.6   Conclusions and Policy Implications

As a rapidly developing country with relatively low urbanization (33%), a high proportion of urban poor without access to housing and infrastructure, India faces unique challenges to building resilient cities. National policies, notably India's National Action Plan on Climate Change (GoI 2008), and more recently, the Smart city program (GoI 2015), AMRUT (GoI 2016) and INDC (UNFCCC 2015) frame an integrated vision of aligning climate policy and development objectives for urban areas.

Integrating climate change into city plans at the development stage can help avoid costs in the long run and prevent adverse impacts arising due to lock-ins. Earlier studies on Indian cities (Pathak et al. 2015) show that an integration between climate change and development is possible and desirable. Policy makers see trade-offs between immediate needs (economic growth objectives) and long-term sustainability objectives. Consequently, sustainability or resilience plans exist as stand-alone plans, disjointed from formal urban development plans. In addition, the top down nature of urban planning, and coordination between multiple planning agencies remain significant challenges. The Ahmedabad case study shows that a robust institutional set up and partnerships among local and state organizations is possible. An earlier assessment of literature shows that the heat warning systems are effective in reducing mortality and morbidity however, efforts could be made to improve access for different groups (Toloo et al. 2013). Future work could possibly explore the differential impacts of resilience plans on different vulnerable groups.

Mainstreaming resilience strategies also requires detailed information on climate science and impacts—for e.g. downscaled climate information for local areas, associated climate risks in the long, medium and short run and methodologies and indicators for measuring resilience. Presently, there exist gaps in the available information on the above. Going forward, urban plans need to integrate a

comprehensive data assessment of future heat projections under different scenarios, their micro level impacts in different zones within the city and develop methodologies to measure and benchmark resilience across different cities.

The paper highlights the planning and governance challenges for mainstreaming resilience in urban planning. With a large urban population in informal areas, building in informality into resilience planning is a necessary precondition to achieve the vision of 'safe climate resilient cities. The paper argues that resilience should be seen beyond conventional and narrow definitions of disaster response and recovery but be viewed in the longer timeframe and a broader framing, incorporating equity and access as basic paradigms.

References

Ayers J, Huq S, Wright H, Faisal AM, Hussain ST (2014) Mainstreaming climate change adaptation into development in Bangladesh. Clim Dev 6:293–305. https://doi.org/10.1080/17565529.2014.977761

Azhar GS, Mavalankar D, Nori-Sarma A, Rajiva A, Dutta P, Jaiswal A, Sheffield P, Knowlton K, Hess JJ (2014) Heat-related mortality in India: excess all-cause mortality associated with the 2010 Ahmedabad heat wave. PLoS One 9. https://doi.org/10.1371/journal.pone.0091831

Baker J (2011) Climate change disaster risk urban poor., pp 1–24. https://doi.org/10.1596/978-0-8213-8845-7

Boonyabancha S (2005) Baan Mankong: going to scale with "slum" and squatter upgrading in Thailand. Environ Urban 17:21–46. https://doi.org/10.1177/095624780501700104

Boonyabancha S (2009) Land for housing the poor—by the poor: experiences from the Baan Mankong nationwide slum upgrading programme in Thailand. Environ Urban 21:309–329. https://doi.org/10.1177/0956247809342180

Childers DL, Cadenasso ML, Morgan Grove J, Marshall V, McGrath B, Pickett STA (2015) An ecology for cities: a transformational nexus of design and ecology to advance climate change resilience and urban sustainability. Sustain 7:3774–3791. https://doi.org/10.3390/su7043774

Coelho K, Raman NV (2013) From The Frying-Pan to the Floodplain: Negotiating Land, Water And Fire In Chennai's Development. In: Rademacher A, Sivaramakrishnan K (eds) Ecologies of Urbanism in India: Metropolitan Civility and Sustainability, Hong Kong University Press, pp. 145–168

Desai R, Mahadevia D (2014) Diversity and dynamics of informal rental housing in a Mid-sized city in India. Environ Urban ASIA 5:285–301. https://doi.org/10.1177/0975425315577173

Dholakia HH, Bhadra D, Garg A (2014) Short term association between ambient air pollution and mortality and modification by temperature in five Indian cities. Atmos Environ 99:168–174. https://doi.org/10.1016/j.atmosenv.2014.09.071

Doshi S (2013) Resettlement ecologies: environmental subjectivity and graduated citizenship in Mumbai. In: Rademacher A, Sivaramakrishnan K (eds) Ecologies of Urbanism in India: Metropolitan Civility and Sustainability, Hong Kong University Press, pp. 225–248

GoI (2008) National action plan on climate change. Government of India, New Delhi

GoI (2014) Report of the expert group to review the methodology for measurement of poverty. Planning commission. Government of India, New Delhi

GoI (2015) Smart cities mission. Government of India. www.smartcities.gov.in/content/. Accessed 18 Feb 2017

GoI (2016) AMRUT mission. Government of India. www.amrut.gov.in/writereaddata/TheMission.pdf. Accessed 8 Mar 2017

IPCC (2014a) Climate change 2014: mitigation of climate change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

IPCC (2014b) Urban areas. In: Climate change 2014: impacts, adaptation, and vulnerability. Part A: global and sectoral aspects. Contribution of work

IPCC (2014c) Annex II: Glossary. In: Mach KJ, Planton S, von Stechow C (eds) Climate change 2014: synthesis report. contribution of working groups I, II and III to the fifth assessment report of the intergovernmental panel on climate change. IPCC

Mahadevia D (2010a) Urban reforms in three cities: Bangalore, Ahmedabad, and Patna. In: Chand V (ed) Public service delivery in India: understanding the reform process. Oxford University Press, New Delhi

Mahadevia D (2010b) Tenure security and urban social protection links: India. IDS Bull 41:52–62

Mahadevia D (2011a) Branded and renewed? Policies, politics and processes of urban development in the reform era. Econ Polit Weekly 46:56–64

Mahadevia D (2011b) Tenure security and urban social protection in India, CSP Research Report 05. Centre for Social Protection, Institute of Development Studies, Sussex

Mahadevia D, Sarkar S (2012) Handbook of urban inequalities. Oxford University Press, New Delhi. ISBN 9780198081715

Mahadevia D, Desai R, Vyas S (2014) City profile: Ahmedabad, CUE Working Paper No 26. Centre for Urban Equity, CEPT University. Ahmedabad

Mahlkow N, Donner J (2016) From Planning to Implementation? The Role of Climate Change Adaptation Plans to Tackle Heat Stress. J Plan Educ Res 0739456X1666478. https://doi.org/10.1177/0739456x16664787

Mathur OP (2013) Finances of municipalities: issues before the fourteenth finance commission. Econ Polit Wkly 48:23–27

National Building Organization (NBO) (2012) Report of the Technical Group (TG-12) on Urban Housing Shortage (2012-17), Ministry of Housing and Urban Poverty Alleviation, Government of India

National Sample Survey Organization (2010) Housing condition and amenities in India, 2008–09, NSS 65th Round, Report No. 535 (65/1.2/1), Ministry of Statistics and Programme Implementation, Government of India

NRDC (2017) Expanding heat resilience across India. NRDC International. Issue Brief. June. https://www.nrdc.org/sites/default/files/india-heat-resilient-cities-ib.pdf. Accessed 1 Aug 2017

Pathak M, Shukla PR (2016) Co-benefits of low carbon passenger transport actions in Indian cities: case study of Ahmedabad. Transp Res Part D Transp Environ 44:303–316. https://doi.org/10.1016/j.trd.2015.07.013

Pathak M, Shukla PR, Garg A, Dholakia H (2015) Integrating climate change in city planning: framework and case studies. Springer, New Delhi, pp 151–177

Puppim De Oliveira JA, Doll CNH, Kurniawan TA, Geng Y, Kapshe M, Huisingh D (2013) Promoting win-win situations in climate change mitigation, local environmental quality and development in Asian cities through co-benefits. J Clean Prod 58:1–6. https://doi.org/10.1016/j.jclepro.2013.08.011

Revi A., Satterthwaite DE, Aragón-Durand F, Corfee-Morlot J, Kiunsi RBR, Pelling M, Roberts DC, Solecki W (2014) Urban areas. In: Field CB, Barros VR, Dokken DJ, Mach KJ, Mastrandrea MD, Bilir TE, Chatterjee M, Ebi KL, Estrada YO, Genova RC, Girma B, Kissel ES, Levy AN, MacCracken S, Mastrandrea PR, White LL (eds) Climate change 2014: impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects. Contribution of working group II to the fifth assessment report of the intergovernmental panel on climate change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 535–612.

Roy A (2009) Why India cannot plan its cities: informality, insurgence and the idiom of urbanization. Plan Theory 8:76–87. https://doi.org/10.1177/1473095208099299

Satterthwaite DE (2011) Editorial: Why is community action needed for disaster risk reduction and climate change adaptation? Environ Urban 23:339–349. https://doi.org/10.1177/0956247811420009

Sharifi A, Chelleri L, Fox-Lent C, Grafakos S, Pathak M, Olazabal M, Moloney S, Yumagulova L, Yamagata Y (2017) Conceptualizing dimensions and characteristics of urban resilience: insights from a co-design process. Sustain 9. https://doi.org/10.3390/su9061032

Shukla PR, Dhar S, Pathak M, Mahadevia D, Garg A (2015) Pathways to deep decarbonization in India. SDSN-IDDRI, Paris, France

Sivaramakrishnan KC (2013) Revisiting the 74th constitutional amendment for better metropolitan governance. Econ Polit Wkly 48:86–94

Sivaramakrishnan KC (2014) Governance of megacities: fractured thinking. Oxford University Press, New Delhi, Fragmented Setup

Toloo G, FitzGerald G, Aitken P, Verrall K, Tong S (2013) Are heat warning systems effective? Environ Heal 12:27. https://doi.org/10.1186/1476-069X-12-27

UNFCCC (United Nations Framework Convention on Climate Change) (2015) India's intended nationally determined contribution. http://www4.unfccc.int/submissions/INDC/Published Documents/India/1/INDIAINDCTOUNFCCC.pdf. Accessed 30 Nov 2016

United Nations (2015) Sustainable development goals—United Nations. http://www.un.org/sustainabledevelopment/sustainable-development-goals/. Accessed 13 Nov 2017

United Nations Department of Economic and Social Affairs Population Division (2014) World Urbanization Prospects 2014

Wamsler C (2008) Achieving urban resilience: understanding and tackling disasters from a local perspective. Proc ICE—Urban Des Plan 161:163–172. https://doi.org/10.1680/udap.2008.161.4.163