Urban Resilience & Climate Change

A Baseline 'Resilience Framework' for Urban Pakistan

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CITIZENS FOR A BETTER ENVIRONMENT

In collaboration with

Friedrich Naumann STIFTUNG FÜR DIE FREIHEIT

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Farhan Anwar

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About the Author

Farhan Anwar did his Bachelors in Civil Engineering and Masters in Urban and Regional Planning and operates as an urban planning and development consultant. He specializes in strategic planning for sector and institutional reforms and change management. His portfolio includes urban sustainability planning and managing participatory planning processes, stakeholder dialogue and consensus building using various participatory planning and social accountability tools - E.g. Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA), Political Economy Analysis, Problem Tree/Logical Framework Analysis (LFA), Citizen Report Card (CRC), and Community Score Card (CSC). He has extended consulting services to the World Bank, Asian Development Bank (ADB), the Japanese International Corporation Agency (JICA), the World Conservation Union (IUCN), WWF Pakistan and several prominent Pakistani consulting firms. He presently also serves as a Visiting Faculty at the Department of Architecture and Planning, NED University of Engineering and Technology, and the Indus Valley School of Arts and Architecture, Karachi, where he teaches Masters and Bachelors courses respectively in Urban Sustainability Planning and Design. He has structured and conducted a number of training workshops and brainstorming sessions to review and assess government policies, plans and projects as they relate to the development sector. He has a number of publications to his credit and contributes regularly to leading English language publications in Pakistan on urban planning, environment, and development issues.

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Introduction

This publication is an attempt to address the issue of 'urban resilience' with a particular focus on its interface with climate change. Climate change is a reality and for countries like Pakistan that are vulnerable to climate change risks, there is an urgent need to initiate well thought out and effectively implemented, monitored and sustained measures for climate change adaptation. Climate change adaptation is often addressed in tandem with the requirement of building 'resilience'. Since the future challenges of climate change find a greater focus in a rapidly urbanizing world, the processes and mechanisms associated with building 'urban resilience' particularly in the context of climate change is therefore now a critical priority of the major urban settlements of the world. Not so in Pakistan.

Apart from some isolated and mostly ill sustained efforts by the government and the civil society that do not form part of larger and holistic 'resilience framework' nothing of note is happening.

As such the aim of this publication is to bring to light the need for urgent action by providing a baseline 'resilience' framework within a context of reviewing our efforts till date and a basic profiling of urban resilience building needs of two of the largest cities in Pakistan – Karachi and Lahore.

Farhan Anwar
Urban Planner
December, 2013

Section 1: What is urban resilience?

While addressing climate change we work within the context that is driven by a dual approach which includes mitigation – measures aimed at reducing the sources or enabling efficient capture of greenhouse gases – and then there is adaptation or resilience building – dealing with the wide spread impacts of the possible climate change scenarios. The focus on mitigation measures lies primarily on the major 'producers' of green house gases – the industrialized world. Adaptation becomes a requirement even for those countries that are not major emitters of green house gases as the impacts of climate change know no national or regional boundaries.In relation to climate change, the terms resilience and adaptation are quite often used interchangeably. In terms of defining these terms, the IPCC (Intergovernmental Panel on Climate Change) defines adaptation as "an adjustment in natural or human systems in response to actual or expected climatic stimuli (variability, extremes, and changes) or their effects, which moderates harm or exploits beneficial opportunities".

When resilience is the aim, it is crucial to understand what the term means and what a resilient city should comprise. As may be expected, there are many definitions of a resilient city, ranging from very narrow to very broad and reflecting different cultural values. One feature, however, that seems to always be present is 'strength' – making communities and cities stronger against destabilizing forces that put their citizens and structures at risk.

Generally, resilience is also linked to sustainable principles. To the

Some Definitions of Resilience

"Resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb change of state….and still persist."

(Holling 1973)

"Resilience for social-ecological systems is often referred to as related to three different characteristics: (a) the magnitude of shock that the system can absorb and remain within a given state; (b) the degree to which the system is capable of self-organization, and (c) the degree to which the system can build capacity for learning and adaptation."

(Folke et al. 2002)

"The capacity of a system to absorb disturbance and re-organize while undergoing change so as to still retain essentially the same function, structure, identity and feedback."

(Walker et al. 2004)

Socio-Economic Inequity - The Resilience Challenge of the Mega City

World Bank, for example, "a resilient city is one that is prepared for existing and future impacts, thereby limiting their magnitude and severity". The World Urban Forum's Vancouver Working Group takes a more confined approach and links resilience to the ability of a city to expand its production base (e.g. from depending on one industry to attracting and embracing a broader base and economy).[1] Yet another definition as those names resilient cities "that can last, make it through crises, [possess] inner strength and resolve, as well as appropriate built form and physical infrastructure".[2] The European Environment Agency (EEA) sees a resilient city as an "urban ecosystem" that is dynamic: consuming, transforming and releasing materials and energy in an adaptive way and interacting with other ecosystems, tackling mitigation and adaptation efforts and addressing quality of life through better and greener urban planning.[3] As a final and quite comprehensive approach, ICLEI's Bonn Resilient Cities conference defines well a resilient city as:

Defining a Resilient City

Resilient city is a city that that supports the development of greater resilience in its institutions, infrastructure, social and economic life. Resilient cities reduce vulnerability to extreme events and respond creatively to economic, social and environmental change in order to increase their long-term sustainability. Resilient city activities are sensitive to distinctive unique local conditions and origins. Efforts undertaken to prevent crisis or disaster in one area should be designed in such a way as to advance the community's resilience and sustainable development in a number of areas. As such, resilient cities define a comprehensive 'urban resilience' concept and policy agenda with implications in the fields of urban governance, infrastructure, finance, design, social and economic development, and environmental / resource management.[4]

According to Judith Rodin, President of the Rockefeller Foundation, USA, resilience means different things across a variety of disciplines, but all definitions are linked to the ability of a system, entity, community or person to withstand shocks while still maintaining its essential functions. Resilience also refers to an ability to recover quickly and effectively from catastrophe, and a capability of enduring greater stress. Humans are not born resilient – we learn it, adapt it and improve upon it. The same is true for organizations, systems, and societies. But what makes some people or organizations more resilient than others?

Through research, practice, and experience – including The Rockefeller Foundation's 100 years of work – we have learned that resilient systems share five core characteristics:

- Spare capacity, which ensures that there is a back-up or alternative available when a vital component of a system fails
- Flexibility, the ability to change, evolve, and adapt in the face of disaster

1 Walisser, Brian; Brent Mueller and Celia McLean (2006). "The Resilient City". The World Urban Forum, Vancouver Working Group Discussion Paper.
2 Newman, Peter; Timothy Beatley and Heather Boyer (2009). "Resilient Cities - Responding to Peak Oil and Climate Change". Island Press. Washington DC. As quoted in: http://sustainablecitiescollective.com/brynajones/28388/what-makes-resilient-city
3 European Environment Agency (2010). "The European Environment – State and Outlook 2010 – Urban Environment". Copenhagen
4 http://resilient-cities.iclei.org/bonn2011/resilience-resource-point/glossary-of-key-terms/ Resilient Communities Program Concept (2002)

Food Security -
Another Challenge of Urban Resilience

- Limited or "safe" failure, which prevents failures from rippling across systems
- Rapid rebound, the capacity to re-establish function and avoid long term disruptions
- Constant learning, with robust feedback loops that sense and allow new solutions as conditions change.[5]

COMMUNITY RESILIENCE

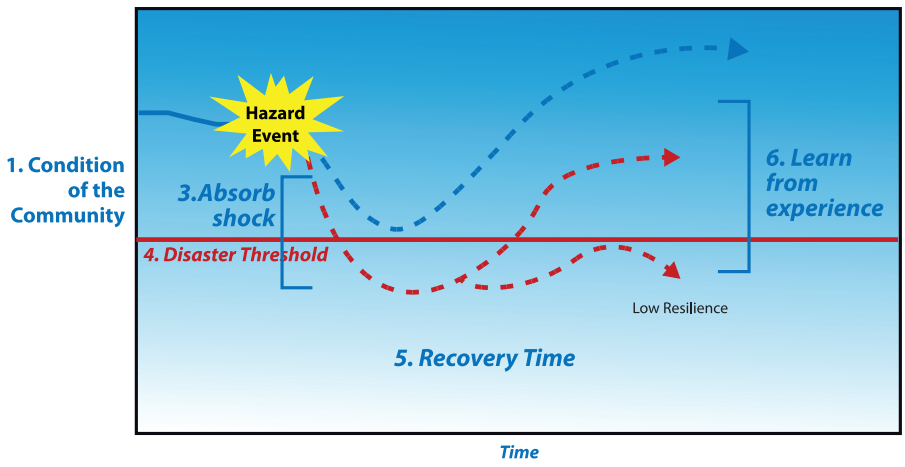
Targeting at the community level, community resilience is the capacity of a community to adapt to and influence the course of environmental, social, and economic change. The resilience of social ecological systems is often described as a combination of three characteristics: the magnitude of shock that the system can absorb and remain within a given state; the degree to which the system is capable of self-organization; and the degree to which the system can build capacity for learning and adaptation (Folke et al. 2002). Common characteristics of resilient systems include redundancy, diversity, efficiency, autonomy, strength, interdependence, adaptability, and collaboration (Godschalk 2003). Resilience provides the capacity to absorb shocks while maintaining function. When change occurs, resilience provides the components for renewal and reorganization (Gunderson and Holling 2002, Berkes and Folke 2002). Vulnerability is the flip side of resilience: When a social or ecological system loses resilience, it becomes vulnerable to change that previously could be absorbed (Kasperson and Kasperson 2001). In a resilient system, change has the potential to create opportunity for development, novelty, and innovation. In a vulnerable system, even small changes may be devastating.[6]

[5] Rebound: Building a More Resilient World – The Rockefeller Foundation

[6] How Resilient is Your Coastal Community? A Guide for Evaluating Coastal Community Resilience to Tsunamis and Other Hazards, U.S. Indian Ocean Tsunami Warning System Program, 2007

Figure:1

Role of Resilience in Determining Community Response to a Hazard Event–



Source: How Resilient is Your Coastal Community? A Guide for Evaluating Coastal Community Resilience to Tsunamis and Other Hazards, U.S. Indian Ocean Tsunami Warning System Program, 2007

The desired outcome or overarching vision for each element of CCR can be described as follows that again has applications in disasters and calamities other than those related with the coast:

A. Governance: Leadership, legal framework, and institutions provide enabling conditions for resilience through community involvement with government.

B. Society and Economy: Communities are engaged in diverse and environmentally sustainable livelihoods resistant to hazards.

C. Coastal Resource Management: Active management of coastal resources sustains environmental services and livelihoods and reduces risks from coastal hazards.

D. Land Use and Structural Design: Effective land use and structural design that complement environmental, economic, and community goals and reduce risks from hazards.

E. Risk Knowledge: Leadership and community members are aware of hazards and risk information is utilized when making decisions.

F. Warning and Evacuation: Community is capable of receiving notifications and alerts of coastal hazards, warning at-risk populations, and individuals acting on the alert.

G. Emergency Response: Mechanisms and networks are established and maintained to respond quickly to coastal disasters and address emergency needs at the community level.

H. Disaster Recovery: Plans are in place prior to hazard events that accelerate disaster recovery, engage communities in the recovery process, and minimize negative environmental, social, and economic impacts.[7]

[7] `How Resilient is Your Coastal Community? A Guide for Evaluating Coastal Community Resilience to Tsunamis and Other Hazards, U.S. Indian Ocean Tsunami Warning System Program, 2007

Section 2: Resilience and climate change

The resilience of social-ecological systems is often described as a combination of three characteristics: the magnitude of shock that the system can absorb and remain within a given state; the degree to which the system is capable of self-organization; and the degree to which the system can build capacity for learning and adaptation (Folke t al. 2002). The more significant and wide spread forms of environmental changes presently are considered as an outcome of alterations in global climate – more commonly termed as 'Climate Change'. Consequences of climate change have social and economic implications other than just environmental impacts and studies on resilience of human settlements are now finding a space increasingly within the embracing 'construct' of climate change.

As per the definition stated in the UN International Strategy for Disaster Reduction (ISDR) 2004 – in relation to climate change scenarios the associated 'risk' is considered a function of the 'hazard' (frequency and severity) and 'vulnerability' (exposure/capacity). For example if we take the case of coastal hazards, then they can be understood as those natural and human induced hazards that occur at the interface between the ocean and the shoreline and vulnerability can be expressed for both 'people' and 'assets' likely to be impacted by such hazards. Hazards can be of varying types including tsunamis, earthquakes, storms and storm surges, flooding, landslides, spills and chronic pollution, shoreline erosion, sea level rise, coastal resources degradation etc. Therefore, while assessing risks, both the hazard and the associated vulnerabilities are taken into account. While at times there is limited information or capacity available to prevent climatic events from taking place, more can be done to reduce vulnerability of exposed 'people and assets' and thereby increase resilience.

Drought: A major resilience and climate change challenge

FINDING A CONTEXT – THE 'RESILIENCE FRAMEWORK'

While the contexts and related opportunities and challenges, capacities or incapacities may differ

from place to place, a number of features can be identified that find a commonality within most resilient systems that when synchronized can provide the overall construct of a 'Resilience Framework'. These may include having an in-built strength and capacity that can be termed as 'redundancy'; having a flexibility to adapt to a crisis and prevent its spiraling impact.; and having the capacity to 'rebound' quickly and evolve over time – not just to survive a calamity but to emerge more strong and more adaptable. What is important to understand is that 'resilience' within a community does not only deliver 'dividends' in times of crisis and sudden calamities but even generally contributes to making for a more secure, healthy, prosperous and integrated community.

In this regard, probably the most comprehensive work has been done by the Institute for Social and Environmental Transition – International (ISET). ISET has developed the Climate Resilience Framework and associated Climate Resilience Framework and training materials.

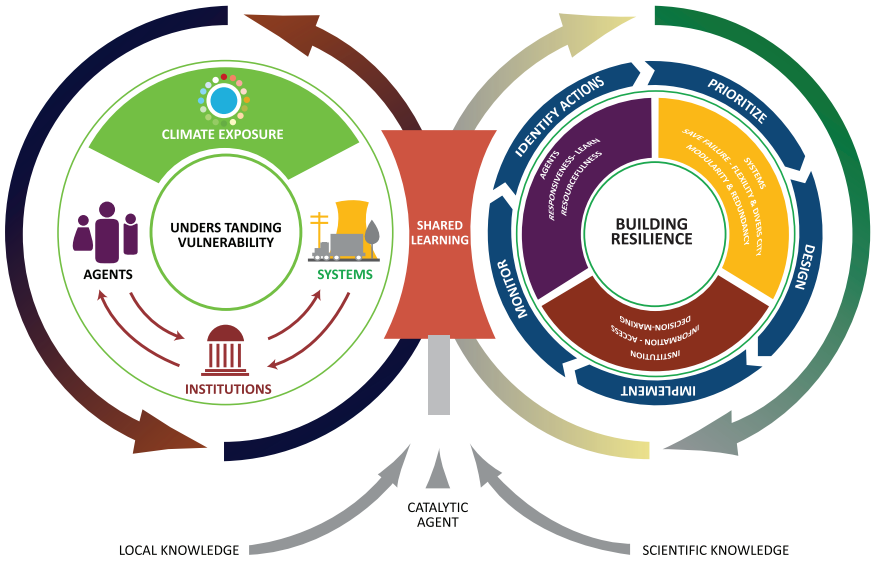
The Climate Resilience Framework (CRF) is a conceptual planning approach to building resilience to climate change. It is designed for practical application, and has been developed from and tested in field situations. The Framework addresses the need for an approach that clarifies complex sources of vulnerability and addresses the complexities of climate adaptation, yet is simple enough for local practitioners to apply in their own context.

The CRF is structured to build a broad understanding of urban resilience by describing the characteristics of urban systems, the agents (people and organizations) that depend on and manage those systems, institutions (laws, policies and cultural norms) that link systems and agents, and patterns of exposure to climate change. It operationalizes these concepts through structured and iterative shared learning approaches that allow local planners to define these factors in their own context, in order to develop practical strategies for local action (Tyler and Moench, in review).

The CRF is composed of 4 main elements, as shown in Figure 2: inputs to the process at the bottom of the figure; a detailed assessment of vulnerability; and, a resilience building component - all facilitated through a shared learning process. The entry point

Figure: 2

Climate Resilience Framework



Source: ISET

into the resilience building process is at the bottom of the diagram, where arrows indicate inputs of local knowledge, scientific knowledge, and a catalytic agent who initiates the process. The "catalytic agent" is intended to be a broad, high capacity organization that can provide training and methodological support to local NGOs or organizations that will directly engage local communities in the local language. The catalytic agent could, for example, be a local climate change working group, a local or regional government department or office, university research or policy team, a national-level organization, or an international level organization.[8]

KEY ELEMENTS OF THE FRAMEWORK

The key elements of the CRF are urban systems, social agents, and institutions, and, for each, the degree to which it is exposed to climate change hazards within the framework (see Figure 3), building resilience means:

- Identifying the exposure of city systems and agents to climate hazards;
- Identifying and strengthening fragile systems by strengthening the characteristics that reduce their vulnerability to climate hazards;
- Strengthening the capacities of agents to both access city systems and develop adaptive responses;
- Addressing the institutions that constrain effective responses to system fragility or undermine the ability to build agent capacity.

Figure: 3

Core elements of the Urban Resilience Framework

Source: Climate Change Resilience Framework: Training Materials Serice 1 Establishing Resilience Principal.

[8] Building Climate Change Resilience – What works, where and why, ISET, 2012

Section 3:
Key Issues in Urban Resilience

While building urban resilience requires implementation of a very holistic approach, from policy level adjustments, to application of new planning strategies to implementation of new or augmentation of existing projects, certain key sectors generally deserve priority attention. The Asian Cities Climate Change Resilience Network (ACCCRN) prioritizes and discusses them as follows:

WATER

Water is certainly one of the most complex issues humanity faces in relation to urban climate change resilience. Access to clean water is a fundamental human right. However, the challenge goes beyond water security. Changing climate patterns have already compromised water sources, and require communities to address a host of challenges including flooding, drainage, salinization of fresh water, sea level rise, glacier and arctic ice melt, over-draught and contamination of groundwater, drought, and efficient water supply to urban areas. Globally, only two percent of water is used for domestic consumption. The bulk is for agriculture, with other major uses for power generation, industry, transport and leisure.

Water Scarcity

Water scarcity is the major long-term risk facing mainland Asia, compounded by seawater intrusion coastally. According to UNEP (United Nations Environment Programme), by the 2020's over 500 million more people may be short of water. Water supply systems are likely to come under greater strain as demand increases, especially in urban areas. In urban areas, resilience building activities in relation to water management have focused on:

- Repair and maintenance of water supply systems to reduce water theft and leaks.
- Green-scaping to improve natural drainage during periods of heavy rain and flooding.
- Increasing the number of supply options to deal with changes in conditions or emergency situations, e.g. rainwater harvesting, introduction of private and/or informal vendors when local supplies are contaminated or energy failures result in suspension to pumped water.
- Water recycling schemes
- Demand management, i.e. public education, industrial process changes to reduce water intensity.
- Reducing heat-island effect

through greening of buildings (excess heat from buildings and roads due to the urban heat-island effect can be transferred to storm water, thereby increasing the temperature of water that is released into streams, rivers, ponds and lakes which exacerbates water pollution).

ENERGY

Increasingly, cities are centers of high demand for energy, and climate change is likely to affect both energy demand and supply. Urban population growth, changing local weather conditions, urban heat-island effects, and economic growth will increase demand, while climate change will affect energy generation and distribution. For example, areas dependent on hydroelectric power generation and experiencing increased incidence of drought are likely to be impacted significantly. A threat to urban energy supplies is a threat to all urban systems. Without power supply, it would not take long for other systems which support essential services, transport and logistics, telecommunications, and financial transactions and economic activity to quickly breakdown. Some of the adaptation strategies that cities are experimenting with include:

- Demand management programs to cut peak load.
- 'Hardening' power plants and networks to increase resilience to flooding, storm and temperature risks.
- Diversifying fuel-mix for city power to increase share of renewables.
- Upgrade of public transport systems to gas or electric power fuelled vehicles.
- Energy saving schemes amongst property managers and enterprises.
- Decentralized energy production, to increase the resilience of the energy system.

Energy Consumption

PUBLIC HEALTH

Climate change presents multiple challenges to the health sector, including acute health care and the public health system in general. This is because the impacts of climate change on health can be both direct and indirect.

1. Direct impacts include: physical injuries from extreme weather events such as typhoons, forest or grassland fires, or ice storms causing fatalities, damage to structures, and creating dangerous transport condi-

Issues in Public Health

tions; illnesses resulting from disruption to access to clean water and food, or increased exposure to biological and chemical contaminants; water borne diseases following extended or intense periods of rainfall, ground saturation and floods, and saline intrusion due to sea level rise; respiratory illnesses due to worsening air quality related to changes in temperature; increase in death rates, especially among the elderly, small children and people whose health is already compromised, as a result of stress from hotter and longer heat waves.

2. Indirect impacts include: increase in the frequency and volume of dehydration; altered food production, affecting yields and nutritional quality; food-borne pathogens and food safety; social, economic and demographic dislocation which may have particular impact on the mental health of individuals and communities.

Due to increasing physical size, population growth and high density, the health risks in cities are amplified. Further, increase in poor and elderly population compound the threats listed above, particularly heat and vector-related illness. Adaptive measures that cities have already begun building into their resilience strategies and activities include:

- Monitoring of water supply quality, for water-borne diseases, environmental pathogens.
- Monitoring of air quality and pollution forecasting (especially for respiratory illness).
- Surveillance for the purposes of outbreak control (e.g. food quality; disease outbreak).
- Early warning systems to alert inhabitants to extreme weather events.
- Planning around infrastructure, e.g. long-term needs in relation to capacity of hospitals and ability to provide essential services; disaster preparedness.
- Development and upgrade of health data systems.

TRANSPORT

As with many other urban systems, transport both contributes to climate change through emissions and is impacted by climate change through frequent disruptions to transportation systems. Globally, according to the 2007 IPCC report, the transport sector

Lack of Decent Public Transport System

accounted for 23 percent of the world's greenhouse gas emissions related to energy in 2004, although in some cities the percentage is much higher. Changing weather conditions can have immediate consequences for travel, causing damage to transport vehicles and transportation infrastructure, such as highways, seaports, bridges and airports, and creating lasting service interruptions.

- Promoting transit-oriented development, reclaiming roadways to provide more space for bicycles and pedestrian walkways, and increasing the amount of mass transit systems available around the city.
- Establishing levees, dams and pumps to limit flood damage around urban transportation routes.
- Improved drainage to protect transport assets.
- Elevation of transport routes and equipment to eliminate flood risk.
- Temporarily move rolling stock in advance of storms.
- Diversifying transport modal choices, i.e. increasing transport options, price, service and systems efficiencies.

ECOSYSTEMS

Ecosystems are extremely vulnerable to the impacts of climate change within and around cities. At the same time, in addition to providing carbon storage, they contribute greatly to adaptation

Threats to Sensitive Ecological Systems

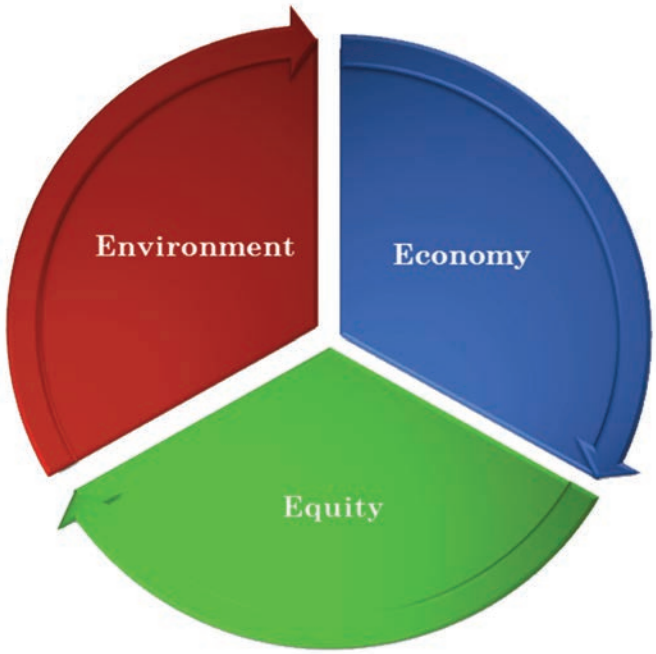
measures, regulating rainfall, water infiltration and flooding and acting as buffers against coastal storms and as reservoirs of biological diversity that will enable various sectors to cope with more extreme conditions. Comparatively, hard infrastructures, including seawalls and levees (often manufactured from materials with high carbon footprints), can be more expensive to build and maintain, while ecosystems can be more flexibly managed than engineered systems to accommodate multiple purposes. For example, floodplains can be used for agriculture or recreation when not flooded, and are used for holding flood waters during periods of high precipitation. Cities have begun to incorporate an ecosystem approach, which put simply means that development of a city resilience strategy requires the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way.

Key messages and actions

Recently, in 2012, a Study, Climate Change, Disaster Risk and the Urban Poor – Cities Building Resilience for a Changing World was conducted by Judy. L. Baker for the World Bank, which brought out some key messages based on observed trends focusing on the critical vulnerability of the urban poor:

- Exposure to the impacts of climate change and natural hazards is on the rise in cities.
- The urban poor disproportionately bear the brunt of changing weather patterns and natural hazards.
- The scope and intensity of disaster risks vary considerably across cities, with differential impacts on the urban poor.
- The increased exposure of the urban poor to extensive risks can transform frequent everyday hazards into disasters.

The Core "Sustainability' Values



Several key findings emerged from the study and provide guidance for addressing risk and are listed as follows:

- The urban poor are on the front line.
- City governments are the drivers for addressing risks.
- City officials build resilience by mainstreaming risk reduction into urban management.
- Significant financial support is needed.

Disaster Risk Reduction in Istanbul

How to go about preparing a Disaster Risk Reduction (DRR) plan

Rebuilding after a disaster is frequently used as an opportunity to improve land use and construction quality. Following the 1999 Marmara earthquake in Turkey, the Istanbul Metropolitan Municipality prepared the Earthquake Master Plan for Istanbul in cooperation with local universities (Metropolitan Municipality of Istanbul 2003). Among many elements, the plan includes an assessment of current vulnerabilities, guidelines on the rehabilitation of existing buildings, and an outline of the urban planning issues necessary to mitigate seismic risk in Istanbul. The document created a Strategic Plan for Disaster Mitigation in Istanbul (SPDMI), with the primary goal of reducing seismic impacts and the secondary goal of improving environmental quality. The SPDMI identified problems associated with planning laws in the Istanbul area that it would seek to improve. First, it identified the lack of mandatory regional planning, which would prevent the cohesive development at the macro level. Second, the coverage and scale of some local plans directly contradict other laws at the metropolitan scale. Additionally, disaster risk mitigation was lacking in available plans, as well as a general tolerance of illegal construction in vulnerable areas. In relation to the built environment, the SPDMI identified an abundance of bureaucratic obstacles in construction, and a lack of a coherent building code, which both encouraged illegal development and substandard construction. Estimates are that 80 percent of the buildings are occupied and potentially renovated without permits. The recommendations for these challenges encouraged the empowerment of metropolitan authorities and the regional seismic commission to assess disaster risks and prepare strategic plans through a disaster-management lens. In relation to the physical footprint and structures within the city, the SPDMI categorized construction according to when the structures were built, who built them (including the permits required), and where these structures were located relative to infrastructure and natural hazards. The SPDMI then identified priority areas for intervention using three steps. First, a location quotient was calculated for the percentage of buildings expected to be heavily damaged (BEHD) in each district. Second, data produced by the Japan International Cooperation Agency on hazard probability, reflecting the density of each BEHD, was analyzed to calculate the standard number of units per hectare. Third, the SPDMI multiplied these values by the building and population densities to gain a clear idea of which areas would suffer the greatest economic or human losses due to an earthquake. Using this information, the SPDMI identified the safest and most beneficial areas for development and retrofitting, and laid out three levels of plans for action. At the macro level, the need to create a national strategy on the spatial basics of social and economic growth was identified, mandating the use of regional plans. Within the regional framework, the environmental assets of the metropolitan areas were identified as serving a hazard-mitigation role. In addition, the national plan identified peripheral areas near Istanbul for resettling high-risk, high-density urban communities.

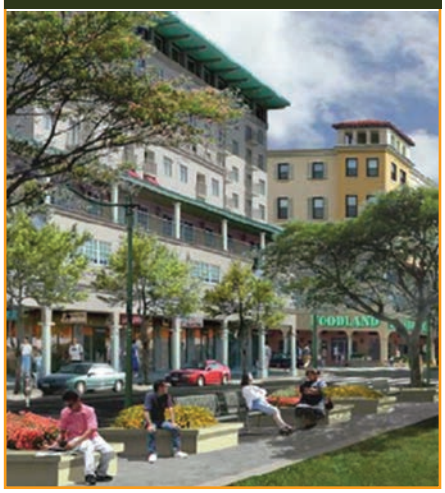
Source: Climate Change, Disaster Risk and the Urban Poor – Cities Building Resilience for a Changing World, Judy. L. Baker for the World Bank, 2012

Section 4:
A Strategy for Urban Resilience: Case Study New York City

In our New York City's long history, we had never seen a storm like Sandy. Water levels at the Battery in Lower Manhattan reached 14 feet; the U.S. Federal Emergency Management Agency had estimated there was a less than 1 percent chance of that happening. The previous record – set in 1960 – was 11 feet. It was a perfect storm – a hurricane that coincided with a full moon and a high tide, and it collided with a second weather front that led it to make a left turn in about the worst possible place, devastating communities and killing 43 people. We may or may not see another storm like Sandy in our lifetimes, but we cannot leave it to our children to prepare for the possibility.

Michael R. Bloomberg
Mayor, New York City

New Urbanism



New Urbanism	
"Giving people many choices for an urban lifestyle in sustainable, convenient and enjoyable place"	
1.	Walkability
2.	Connectivity
3.	Mixed-Use & Diversity
4.	Mixed Housing
5.	Quality Architecture & Urban Design
6.	Traditional Neighborhood Structure
7.	Increased Density
8.	Smart Transportation
9.	Sustainability

The reason why New York's efforts at building 'urban resilience has been selected is that it offers a holistic approach that focuses on aspects of policy, planning, promotion of innovations in practices and technologies, establishing of forums for coordination and action - a whole range of actions that go into building 'urban resilience'.

Some relevant excerpts from the NYS 2100 COMMISSION - Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure, 2012 have been cited here to bring out the ethos of the strategic vision and planning methodologies.

As New York continued to recover from the devastations brought about by super storm sandy, their decision makers also turned their attention to the future. They decided that their response and the ability to bounce back stronger must be developed and strengthened. The storm also brought into light a vastly deeper understanding of the city's current vulnerabilities. They decided not just to restore what was there before – but to build back better and smarter. The focus was on increased resilience: the ability of individuals, organizations, systems, and communities to bounce back more strongly from stresses and shocks and making them more integrated.

On November 15, 2012, Governor Andrew Cuomo convened the NYS2100 Commission in response to the recent, and unprecedented, severe weather events experienced by New York State and the surrounding region: most recently, Super storm Sandy, Hurricane Irene, and Tropical Storm Lee. The Governor

asked the Commission to examine and evaluate key vulnerabilities in the State's critical infrastructure systems, and to recommend actions that should be taken to strengthen and improve the resilience of those systems. The Commission reviewed the vulnerabilities faced by the State's infrastructure systems, and developed specific recommendations that can be implemented to increase New York's resilience in five main areas: transportation, energy, land use, insurance, and infrastructure finance. These recommendations are aimed to:

A One Acre Urban Farm in the Long Island City Neighborhood of Queens

- Identify immediate actions that should be taken to mitigate or strengthen existing infrastructure systems – some of which suffered damage in the recent storms – to improve normal functioning and to withstand extreme weather more effectively in the future;
- Identify infrastructure projects that would, if realized over a longer term, help to bring not only greater climate resilience but also other significant economic and quality of life benefits to New York State's communities;
- Assess long-term options for the use of "hard" barriers and natural systems to protect coastal communities;
- Create opportunities to integrate resilience planning, protection and development approaches into New York's economic development decisions and strategies; and
- Shape reforms in the area of investment, insurance and risk management related to natural disasters and other emergencies.[9]

The cross-cutting and sector specific 'recommendations' that came out of this Commission Report offer many strategic guidelines for our decision makers and managers in the larger cities of Pakistan for initiating 'holistic and multi-sector' resilience building measures. Discussed in brief are some of the key cross cutting recommendations:

CROSS-CUTTING RECOMMENDATIONS

Protect, upgrade, and strengthen existing systems

State agencies and authorities can take specific short-term action to significantly improve the long-term resilience of New York State's critical infrastructure systems. These include returning aging and damaged transportation, energy, drinking water and wastewater systems to a state of good repair; replacing irreparably damaged infrastructure with more resilient alternatives; and providing services and protections through new measures, such as natural infrastructure projects and coastal ecosystem restoration, to create additional lines of storm defenses.

[9] NYS 2100 COMMISSION - Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure, 2012

Rebuild smarter: ensure replacement with better options and alternatives

As the rapid recovery and response continue to move forward, it is essential to identify where one-to-one replacement is not the best option for long-term resilience building. This recommendation focuses on transitioning from short-term solutions to long-term resilience measures. The State should develop scenario-planning capability to explore policy options for guiding where to build, what to build, and how to strengthen communities in areas of greatest risk. Scenario planning exercises should be held with communities across the state to inform and guide decisions about long-term rebuilding efforts, future investment plans, and the level to which we rely upon "soft" solutions or harden and upgrade our infrastructure.

Encourage the use of green and natural infrastructure

The Commission recommends that New York State adopt measures that promote the use of green and natural infrastructure through direct investment, new incentive programs, and education. A green infrastructure approach emphasizes the use of solutions that maintain and support services provided by natural systems, such as wetlands and dunes that can serve as natural buffers against storm surges and complement efforts to build new traditional infrastructure to protect communities. There have been many severe weather events where a broader adoption of green infrastructure could have minimized local problems with flooding, contamination or erosion.

Extensive promotion of BICYCLING

Promote integrated planning and develop criteria for integrated decision-making for capital investments

New York State has a variety of planning processes. Ensuring that resilience is effectively incorporated into the State's many complex systems and plans requires new approaches to both planning and implementation. Responsibility for the State's infrastructure is shared, with no single institution in charge. Transportation, energy, and utility infrastructure are networked systems such that delays, failures, or catastrophic failures in one system can disrupt other systems. In several areas, the Commission recommends a more integrated planning function or process across agencies and authorities. For example, integrated planning is an essential first step to creating a comprehensive coastal management strategy

and inventory that ensures multiple lines of defense for vulnerable communities.

Enhance institutional coordination

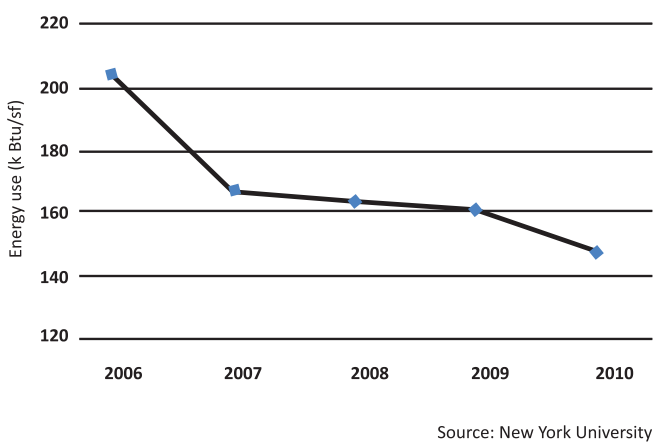
The Commission recommends several key actions to streamline New York State's approach to planning for and implementing resilient development strategies. Recommendations include the creation of a new Chief Risk Officer or unit to provide a platform for coordination between different State agencies and neighboring municipalities and create the basis for an "all hazards" approach to planning, investment, and decision-making. Improving coordination within and between levels of government also offers opportunities to minimize duplication and conflict among agencies, find areas of cooperation to make better use of tax-payer dollars, and improve outcomes for citizens and communities.

Improve data, mapping, visualization, communication systems

Information systems include both the hard data that need to be found, processed, updated, secured and stored in ways that can by effectively used and also the wide range of institutions and individuals who make up the user community of these data. The hard data inform decision-making, interactions between systems, and coordinated management. They also serve as a tool to inform State decision-makers and others so that they can better understand how best to support the general well-being and welfare of the State. One example of this type of infrastructure is the State's Critical Infrastructure Response Information System (CIRIS), which uses Geographic Information Systems (GIS) technology to support analysis, visualization, and decision-making. Further improving the State's information systems

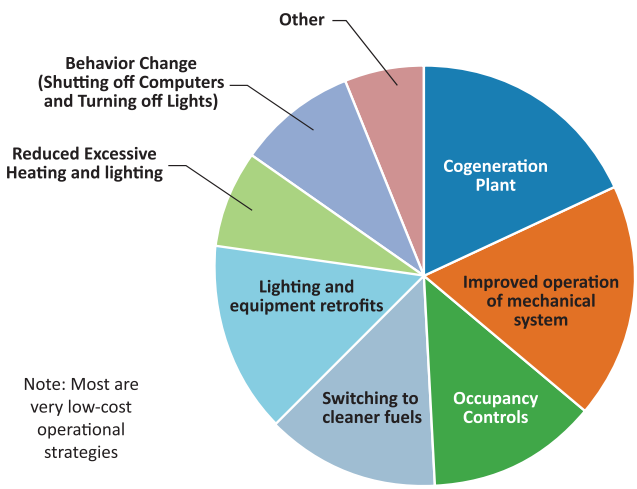
Figure: 4

New York University's Energy Reductions



Source: New York University

Key Component's of NYU's Energy Reduction Strategy



Note: Most are very low-cost operational strategies

Source: New York University

can enhance the governance and management of the State's infrastructure during normal operations and also create essential feedback loops to support real-time decision-making and response during and after emergencies.

Create new incentive programs to encourage resilient behaviors and reduce vulnerabilities

In several areas, the Commission recommends the use of incentive programs to influence regional, municipal, and individual decisions and behaviors to encourage more resilient development. For example, various land use programs are identified to support longer-term smart growth patterns that avoid areas of high and increasing vulnerability. The Commission recommends programs designed to expand green storm-water infrastructure; promote energy efficiency and alternative fuels; and reinforce or mitigate vulnerable assets, equipment, or buildings, or homes.

Expand education, job training and workforce development opportunities

New York State should expand investment in education and workforce development programs to ensure the availability of skilled professionals in critical recovery and resilience building activities, including restoring ecosystems, creating and maintaining green infrastructure, repairing damaged equipment and upgrading services. Growing the pool of available skilled workers is essential to handle the current and future needs of critical infrastructure systems, such as electric power and environmental engineering. Infrastructure jobs often require highly skilled workers with years of training; investment in training programs should begin immediately to account for future needs. Creating a larger network of training programs will help form a foundation for the continued development of New York State's workforce for years to come.

Section 4: The Pakistani context to climate change and urban resilience

While Pakistan is vulnerable to adverse impacts of climate change, its own contributions to the total global GHG emissions are limited (about 0.8%) and its per capita GHG emissions correspond to about one-fifth of the average for Western Europe (IEA/OECD 2006). Pakistan was thus ranked at 135th place on the basis of its per capita GHG emissions without land use change and at 149th place when land use change was also taken into consideration (US-DOE 2009).[10]

However, Pakistan can be considered vulnerable to climate change due to both internal and external 'triggers' and the main thrust of the country's response to climate change is required to be focused on adaptation measures. Pakistan's land area is mostly arid and semi-arid (about 60 per cent of the area receives less than 250 mm of rainfall per year and 24 per cent receives between 250-500 mm).[11]

Its rivers are predominantly fed by the Hindu Kush-Karakoram-Himalayan glaciers which according to various projections are reported to be receding due to global warming.

The process undertaken to address the climate change challenge was sensible but the Climate Change policy left much to be desired particularly with regards the rapidly increasing urbanization challenge in Pakistan. The notified Climate Change Policy for Pakistan, approved by the Federal Cabinet directs attention mostly on agriculture, forestry and water resources and separates out urban activities into a sector based categorization rather than consider them in a holistic urban context, what to talk of issues like urban climate change resilience. There has now

Responding to Climate Change

1992: Pakistan signed and ratified the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC)

1995: Cabinet Committee on Climate Change was established to serve as a policy coordination forum

2002: Global Change Impact Studies Centre (GCISC) was established as an autonomous institution mandated to conduct modeling-based research on climate change, especially its impacts on agriculture and water resources

2004: The Cabinet Committee was converted into the Prime Ministers Committee on Climate Change

2007: The Ministry for Environment established a "Core Group" in the context of the negotiations underway at the UNFCCC following the adoption of the Bali Plan of Action (2007)

2008: A Task Force on Climate Change was set up by the Planning Commission of Pakistan

2010: The final report of the Task Force issued

2012: Climate Change Policy approved by the Federal Cabinet

2012: A Federal Ministry for Climate Change constituted

2013: The Federal Ministry of Climate Change downgraded from a Ministry to a Division

[10] Task Force Report on Climate Change, 2010, Planning Commission, Government of Pakistan.
[11] Task Force Report on Climate Change, 2010, Planning Commission, Government of Pakistan.

been even a setback in terms of institutional space and financial provisions. The June 2013 national budget registered a cut of over 62% in annual spending for Pakistan's Ministry of Climate Change and it has also been downgraded from a Ministry to a division.

Impediments to resilience building: The Pakistan context

If we look at the context of Pakistan, then we are faced with multiple challenges in making our urban settlements 'resilient'. They can be listed as follows:

- Currently, no umbrella framework or legislation exits either at the national or city level which addresses the issue of urban resilience
- There is a wide distribution of 'jurisdictions', 'management roles' and overlaps in terms of policies, control over land and resources and financial matters spread across all tiers of governance (federal, provincial and local) that prohibit a pro-active role being initiated at the urban level
- There are serious inadequacies in research and documentation, particularly mapping (e.g. hazard mapping) accurately profiling the 'vulnerable communities' and 'assets'
- In terms of determining the possible 'frequency' and 'severity' of potential hazards, the projections are more in the nature of 'guesstimates' rather than being based on any authenticated and long term 'database'
- Communities and institutions (particularly critical institutions such as emergency response agencies – healthcare, fire service, civil defense) are severely ill trained, ill equipped and financially constrained to effectively meet a possible challenge

Disaster management authorities have been established both at the national – National Disaster Management Authority (NDMA) and provincial levels - Provincial Disaster Management Authority (PDMA) with high ambitions and laced with policies and planning mechanisms. There is the National Disaster Management Act 2010 and the National Disaster Risk Reduction (DRR) Policy in place, but in the ceases of recent disasters such as flooding, these institutions have been found wanting in terms of implementing effectively there impressive plans and actions.

Section 5: Urban resilience challenges in Pakistan – Profiling Karachi and Lahore cities

Karachi City

KARACHI CITY

Karachi City, from very humble beginnings about three hundred years ago has now grown into a throbbing, pulsating Megapolis – with an estimated population in the range of 20 million. From early times, even before the British, Karachi functioned primarily as a trading city and has since then remained a multi-ethnic city that has retained its urban character. Karachi, the capital of Sindh province, is now the commercial hub and gateway of Pakistan. It accounts for 95 per cent of Pakistan's foreign trade and contributes 30 percent of Pakistan's industrial production. Nearly 90 per cent of the country's head offices of banks, financial institutions. A few critical areas where there needs to be focus along with cross cutting issues that have the potential of reducing the resilience capacity of the city are discussed (Excerpts from Karachi Climate Change Adaptation Strategy: A Roadmap, Farhan Anwar, FNSt, 2012)

1) Urban Flooding

Karachi has had to face urban flooding events in the past and it can happen again. It is however difficult to work out a probability and related intensity with any degree of accuracy owing to serious gaps in data and associated research both in terms of anticipated precipitation levels and the translation of additional rainfall into an urban flooding event. The risks while they cannot be accurately quantified in terms of exposed and vulnerable

people and assets there is sufficient indications that risks can be quite substantial. The potential people and communities likely to be in the flood hazard zone are also fitting the profile of being highly vulnerable.

The assets at risk figure significantly not only at a local but national level in terms of the focus has been to take either a fire-fighting approach with all the associated inadequacies in response mechanisms in tact or to take short term ad-hoc measures with no sustainability attached to them. Climate change adaptation is all about being prepared. From reducing the risk of damage to being better equipped to meet the possible consequences is what adaptive capacity is all about. For that to happen, a paradigm shift in planning priorities is required. The need is to move urgently on multiple fronts to address this issue that may include an intensified focus on research and analysis and implementation of relevant policy frameworks for facilitating required planning and project based interventions.

2) Drought

The probability of a drought affecting Karachi would depend upon how much rain falls, how long are periods of reduced rainfall, and how sensitive the supply-demand balance for the various service areas is to drought. Ideally, based on such an analysis the water service provider could divide its supply area into smaller water resource zones, which are defined on the basis of water supply connectivity. Such estimation for us does not exist. However for us, a critical realization should be that a drought scenario will not bring a crisis, it may aggravate an already existing crisis. There is an urgent need to reduce the loss of water through leakage management that can happen within the context of a larger initiative to rehabilitate the decaying infrastructure and prevent theft. Water efficiency can be improved through introducing water metering that can lead to proper estimation of demand and development of related trends in fluctuations in uses and also identifying the more water stressed areas.

There is a need to promote water conservation practices both at the service provider and the consumer level. There is huge water efficiency potential in using reclaimed water for non-potable uses. However, for all this to happen, the water utility needs to be financially viable to begin with. A political will for holistic institutional reforms backed

Settlements Along River Beds - Extreme Vulnerability to Urban Flooding

Urban Poor Most Vulnerable to Water Scarcity and Drought Conditions

by relevant policy and administrative interventions are the only way to address this challenge. Within the context of the rural agro urban sector in Karachi, there is an urgent need to protect and replenish the ground water resources through relevant policy and project based interventions in addition to looking at promoting judicious use of the water resources. This can happen within a larger framework of protecting the threatened land use of the rural hinterland and developing a new vision of this land mass and related economy as a viable and sustainable source of providing food security for Karachi and also acting as a barrier to the unplanned, unregulated and unsustainable urban sprawl.

3) Extreme heat events

Lack of appropriate data and research again act as a constraining factor in determining the presence and extent of the relevant climate change impacts such as the urban heat island effect. However, possible contributing factors can be identified and mostly relate with the unplanned and unregulated growth that has now become the norm in Karachi's development scenario. Options for horizontal growth are now negligible if not already exhausted within the inner city and vertical growth scenarios are being considered – however, without proper consideration for the social, environmental safeguards necessary for making them a viable planning and development strategy to accommodate residential and commercial growth pressures. An appalling lack of focus and priority on providing the city with socially, environmentally and financially viable public transport options has led to a phenomenal growth in the numbers of private vehicle usage that is now globally being discouraged as a sustainable mode of transport in terms of adverse impacts on the environment and sustainable growth of urban settlements.

For water focus is largely on augmenting water supply. While such an action can provide benefits in the short run, it cannot on its own provide a viable and lasting solution to the crisis unless it is linked with measures to drastically reduce water loss and actively work to promote water conservation and waste water reclamation practices to lessen the pressure on the already stressed water supply resources. A new paradigm in water resources management has to be envisioned by working with a basket of options for improved service provision and institutional reforms

4) Sea level rise

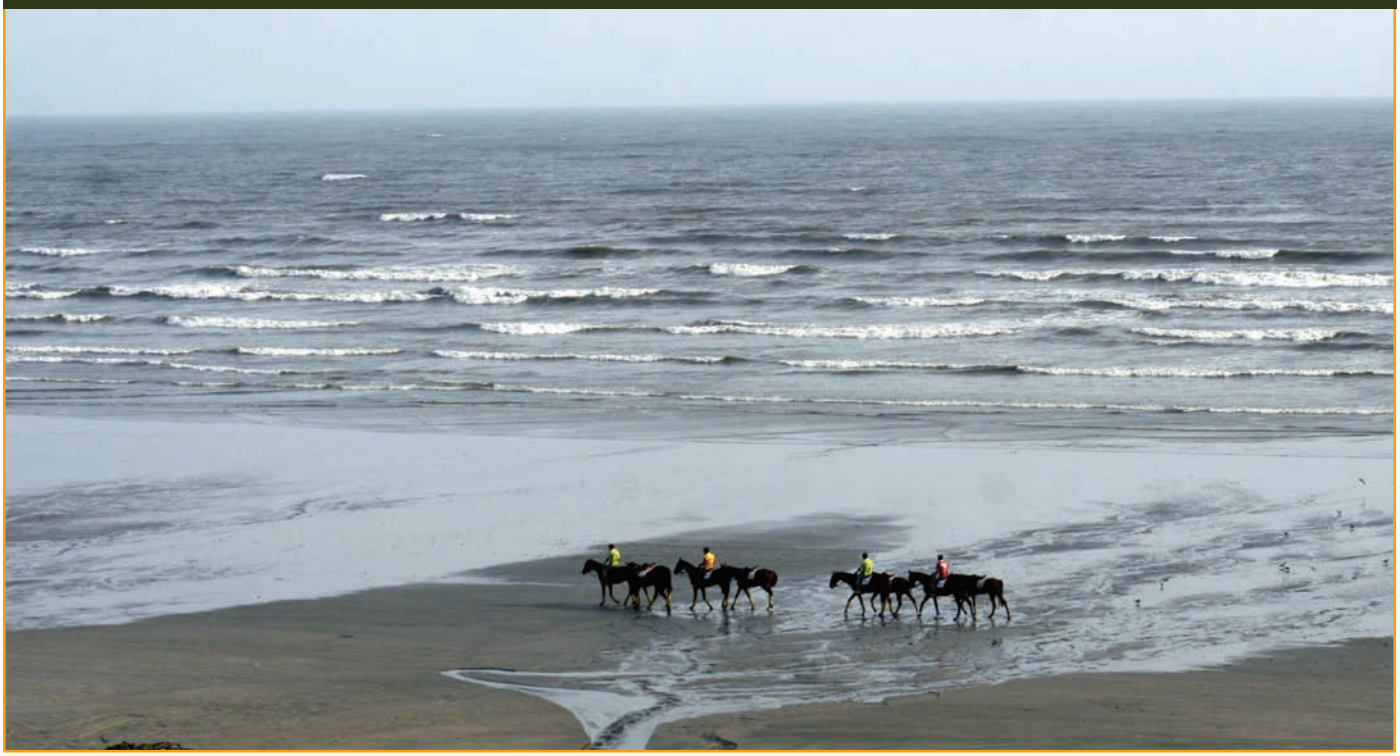
As with the case of other climate change scenarios, here again, there is a desperate need for research, filling of data gaps and working with data to inform appropriate decision making, starting with the outlining of areas of greatest vulnerability to coastal hazards. Shoreline inventories should be completed for public and private infrastructure and assets in addition to the status of the threatened bio-diversity and supporting ecosystems. The relevant agencies and authorities must continue to monitor coastal processes and improve understanding of how they will be affected by sea level rise.

Protective measures against flooding say from a cyclonic event need to be considered, such as constructing flood protection barriers, sea walls, beach nourishment or diverting and concentrating flood waters to more confined locations. However, another long term threat for which consideration can be given now is within the context of what is termed as residual damage – where irreversible damage takes place from a climate change scenario. This is more relevant in the case of sea level rise as rising sea level and resulting erosion may result in loss of coastal land.

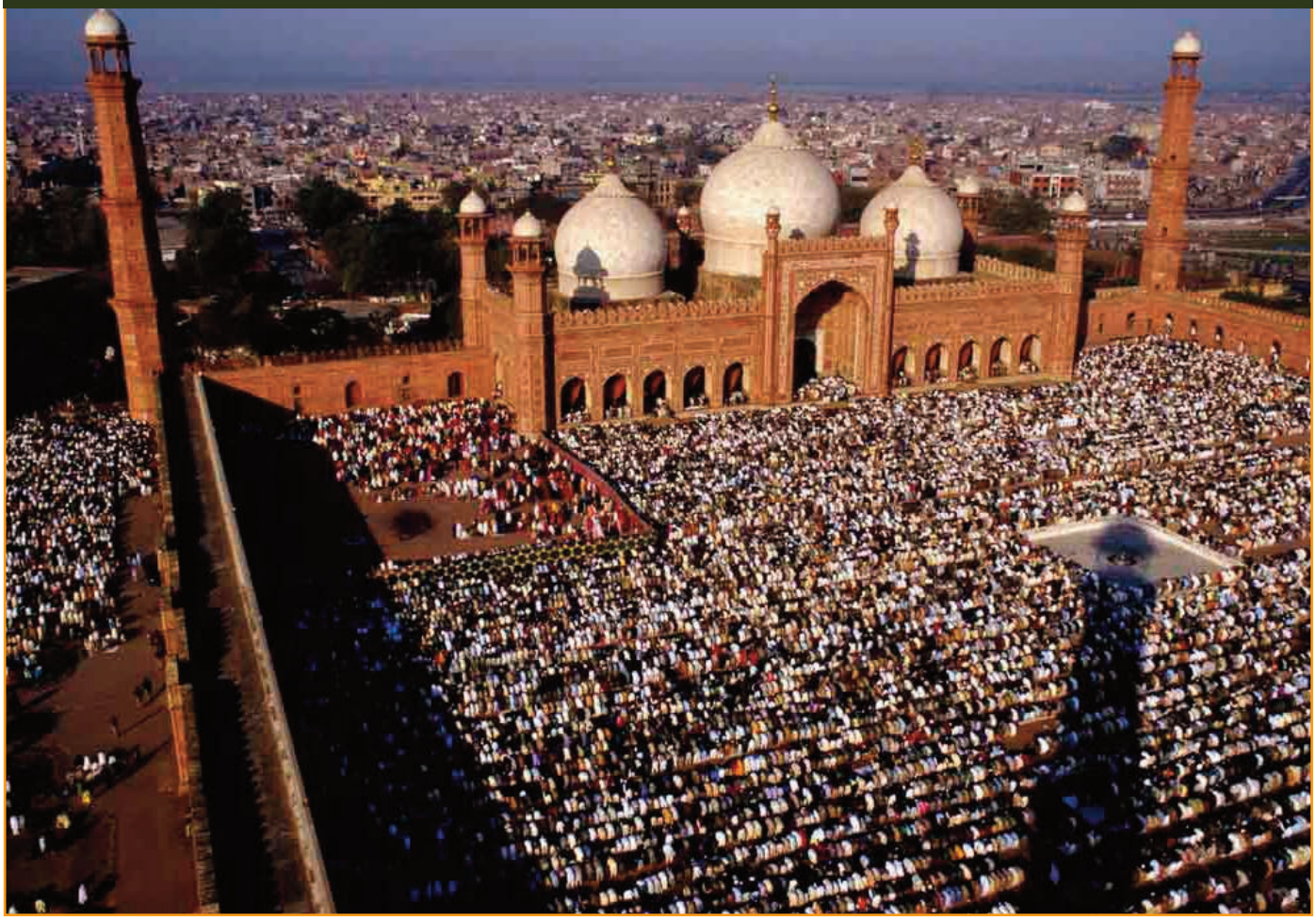
LAHORE CITY

Lahore city, capital of the province of Punjab and the second largest city in Pakistan is a city with a rich heritage and civilization and has been at the

Sea Level Rise can Affect Unprepared Coastal Communities



Lahore City



threshold of many historic events. The residents take pride in their association with the city which is a big positive in building resilience. However a few critical areas where there needs to be focus that have the potential of reducing the resilience capacity of the city

1) Energy crisis

Lahore is faced with a serious energy crisis with frequent power breakdowns adversely affecting domestic, commercial, industrial and farming activities. There is also damaging impact on infrastructure services such as water supply and transportation. Such lapses in infrastructure and services, that include critical emergency response systems such as fire services and healthcare facilities places Lahore city at a severe level of 'vulnerability'

2) Emergency Response

In any post disaster situation, the most critical defense is an 'efficient emergency response system' that may include fire services, law and order apparatus, health care etc. in addition,

Energy Crisis - A Major Concern in Lahore

properly located and adequately equipped 'evacuation shelters' coupled with well drilled and effectively disseminated evacuation plans are something that the city of Lahore needs with provision for effective inter-agency coordination and interface.

3) Population growth and urban sprawl

The urban area of Lahore has now expanded resulting in unregulated urban sprawl. The estimated population of Lahore is around nine million, whereas the

Ground Water Depletion And Contamination - Dual Challenge For The Lahore City Managers

population of Lahore Division is estimated to be close to 15 million, further expected to double in next twenty five years. This realization requires effective planning to prevent uncontrolled densification that can lead to possible 'heat island effect', greater stress on resources and infrastructure, increase in financial and social disparity and social stress.

4) Urban Flooding

Lahore is prone to the damaging impacts of 'urban flooding' that includes damage to property and infrastructure, loss of life and livelihoods, financial setbacks etc. Presently, hazard zone mapping does not exist that can locate the 'exposed' people and assets in the projected flood zone so that there 'vulnerability profile' can be developed and efforts made to reduce their vulnerabilities and increase resilience. The vulnerable 'people' and communities' are one those that are in the direct 'exposure zone, normally living in make shift, shanty dwellings, along river beds and drainage networks, often not having land tenure, of poor health and financially constrained. They also do not have access to certain basic services that adds to their vulnerabilities. Financial 'flood insurance mechanisms' mechanisms do not exist. Often, such a calamity does not only

Urban Flooding - Another of Lahore City's Resilience Challenge

damage their dwellings but also their means of earning and sustenance adding further to the 'vulnerability profile'. While no extensive 'flood hazard mapping' has been done to identify and quantify exposed people (particular focus on the elderly and children) and assets, a significant number of people are estimated to reside along the flood plains of the Ravi River and inner city drainage network. Short term emergency response and shelter facilities get provided in the case of a disaster but there is a lack of an integrated 'evacuation' and disaster risk management plan with provisions for relevant actions embedded in the appropriate legislative and institutional frameworks. Healthcare facilities get overstressed leading to setting up of makeshift medical supply systems that are often not regulated. There is a need for an integrated plan for long term planning for recovery, rehabilitation and resettlement. In terms of assets, again 'flood hazard' mapping can lead to identification of assets and their prioritization in terms of their continuous functions in times of crisis example. Power and water supply, fire services, healthcare facilities etc.

5) Promotion of non-motorized transportation

Lahore is served with a newly inaugurated 'metro' bus based public transport system. However need exists to increase the dividends by one going for forms of 'transit oriented development' (TOD) to promote a 'compact' city model rather than face an urban sprawl and also promote walk ability and bicycling – all steps having a bearing on reducing carbon emissions, lowering the energy consumption levels, preventing damage to Lahore's rich historical heritage and promoting an inclusive city.[12]

Note: Excerpts for the section on Ladore city referenced from a paper'Resilient City-Lahore, Urban unit, Government of Punjab , by the same author.

(Farhan Anwar)

[12] Paper on 'Resilient City Lahore, Farhan Anwar, Urban Unit Punjab, 2013

Section 6: Towards a Roadmap for a 'Resilience framework'

Risk is a function of hazard and vulnerability. Any effort to develop an 'Urban resilience framework for Pakistan', encompassing all key stakeholders would have to start with an assessment of existing status. The central role would have to be parked with the City Governments of the cities. If we focus on 'communities' and 'institutions' than the following steps can be initiated:

- Initiate a dialogue between the communities, relevant government organizations, civil society groups and other relevant stakeholders on defining the larger vision, goals and key elements of a 'resilience framework'.
- Develop a demand and acceptance through awareness creation on the risks associated with climate change related hazards and the benefits that can be accrued by building resilience capacity at the community and institutional level.
- Determine and profile the resilience status and capacity of communities and institutions for identifying strengths, weaknesses and gaps in the resilience capacity that the 'resilience framework' would have to address.

While the city government takes the key role, a number of stakeholders would have to form an integral part of the 'resilience planning' process. For this purpose an institutional forum of a 'City Climate Resilience Task Force' can be instituted. Critical stakeholder composition will come from relevant government agencies, private sector, trade and business, civil society, academia, economists, planning and development practitioners etc.

The process would need to start with a larger visioning process leading to the establishment of short, medium and long term goals linked with clearly defined indicators for measuring trends and setting benchmarks. A strictly enforced monitoring and evaluation regime has to be incorporated in the overall implementation process.

It is important that the city government is truly empowered to steer and coordinate the process as the true guardians of the city. Enabling legislative and institutional interface would be needed to engage the private sector in a meaningful manner while an active civil society engagement in terms of input in design and implementation of the process would ensure the much needed legitimacy and public ownership of the process.

It will have to be ensured that resilience measures capable of coping with the potential climate change scenarios would have to be embedded across the board in the functioning of institutions and agencies, private sector and civil society rather than strategizing for a 'special' agency for dealing with the task in hand.

With regards urban flooding there is a need to determine the potential frequency and magnitude of possible urban flooding scenarios. This should then lead to the establishment of a 'Flood Plains' wherein the 'exposed' communities and assets and their vulnerability factors can be combined to produce an 'index of flood vulnerability' which can then be plotted using census data to map vulnerability. The drainage network needs to be assessed in detail for its design and structural capacity to cater to extreme flooding scenarios.

Response measures could include reducing the vulnerabilities in terms of better housing options, training in first aid and basic rescue drills, relocation, knowledge and access to clearly disseminated 'evacuation' plans

etc. Physical barriers are also an option such as flood embankments. In addition, for legally located households and businesses the government needs to initiate 'Flood Insurance Schemes' based on the probability of the flooding event where assistance is required. Addition of more green and open spaces in strategically located parts of the city can also act as a defense by acting as 'infiltration basins'.

All this would require a detailed analysis and planning leading to use of relevant technology such as GIS technology and climate data simulation and trend development scenario would be required.

Then there are the consequences of population growth. This would require a comprehensive planning exercise to vision our cities as 'Compact and Smart Cities' and prevent the present trends in urban sprawl and here technical help would be needed – promotion of public transportation linked with 'transit oriented development', a bicycle route plan, renewable energy technological options and an assessment of their possible applications from the household to the city wide level. Needed is the introduction of the concept of 'green buildings' with the establishment of localized standards that can take inspiration from the LEED standards in the USA and for this technical help is required. There would be a need to introduce scientific data generation techniques such as 'surface temperature mapping' to measure possible indications of 'urban heat island effect'.

A comprehensive training and capacity building program needs to be initiated within communities and institutions targeted at resilience building for which specific 'resilience building' and 'benchmarks' need to be set. Specialized TNA (Training Needs Assessment Programs) need also to be initiated and technical input would be required.

It would also be a valuable investment in the future if in a selected academic institution/s a special 'department' or 'program' specifically dealing with 'climate change/climate change resilience' is established so that we can develop a future cadre of qualified human resource for sustaining efforts.

A critical requirement of the success of the 'resilience plan' is the empowerment and strengthening of the city government to develop appropriate policies, forge collaborations and partnerships and create the enabling legislative and institutional interface where key segments of the society are in a position to join hands for building resilience. In this regard gaps and weaknesses that presently exist in the governance framework of the city government will have to be addressed.

Another desired impact would be the building of alliances and collaborations – govt., private sector, civil society etc. Resilience is all about the capacity of the various segments of society to come together in a time of crisis and contribute in absorbing the shock and bouncing back stronger. This can happen if there is integration in terms of disaster risk management procedures, recovery and rehabilitation etc.

Then the steps that need to be taken to make a city a resilient city do not necessarily have to be driven by a specific 'climate change' threat. If we are promoting public transportation modes, reducing our energy consumption and carbon emissions, increasing green spaces than these are the things that we need to do anyway to make our city a better place to live in. What is

important in terms of resilience is that there is integration and awareness and people are equipped and are supported also by government support to enable a quick recovery. In this regard a special focus has to be on having a highly trained and adequately equipped 'emergency response infrastructure' –healthcare, paramedic support, fire services, evacuation and shelter planning and facilities etc.

- Our cities would be resilient cities if they are in a position to better protect, upgrade their civic and emergency response infrastructure.
- When they rebuild smarter, go for compact growth rather than urban sprawl.
- When they promote green and natural infrastructure.
- When they take steps to promote integrated planning and strengthen institutional coordination.
- When they invest in and sustain continuous data generation, mapping, trends development and effective communication systems.
- When the government creates the enabling space and a strategic framework for engaging non-government stakeholders.
- Establishes centers and research forums for long term academic and carrier training.
- Have not just a development plan but a comprehensive financial plan in place to implement the resilience targets.

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