# Training Module
# on
# Urban Risk Reduction and Resilience:
# A Comprehensive Approach
# (Basic Course)

**GUJARAT INSTITUTE OF DISASTER MANAGEMENT**

BUILDING RESILIENCE

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# Training Module on Urban Risk Reduction and Resilience: A Comprehensive Approach (Basic Course)

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# Message

Dear Readers,

Gujarat has witnessed rapid population growth, especially in urban areas. Cities like Ahmedabad, Surat, Vadodara, and Rajkot have seen substantial increases in population due to migration from rural areas and other states. Gujarat is known for its industrial development, including sectors such as textiles, petrochemicals, pharmaceuticals, and manufacturing. This industrial growth has led to the establishment of industrial clusters and special economic zones, attracting investment and generating employment opportunities.

While urbanization brings several opportunities for economic and social development, it also poses various challenges. Rapid urbanization has put a strain on existing infrastructure, including transportation, water supply, waste management, and healthcare. Inadequately planned and managed cities pose new risks that jeopardize existing development achievements. Insufficiencies in infrastructure and services, unsafe housing conditions, and inadequate healthcare services can transform natural hazards into full-fledged disasters.

Looking to this, a training module on '**Urban Risk Reduction and Resilience: A Comprehensive Approach**' is developed focusing on the crucial task of building resilient cities. It will provide a comprehensive understanding of urban risks, their underlying causes, and effective strategies for risk reduction and management. Further, through interactive training sessions, case studies, and practical exercises during the training based on this module will give insights into best practices and innovative approaches for creating sustainable and resilient cities.

I take the opportunity to thank Shri Mukesh Puri IAS (former Addl. Chief Secretary, UD& UHD) and Shri. Ashwini Kumar IAS, Principal Secretary, Urban Housing and Urban Development Department, for the invaluable support in the development of training module. We are also thankful to Shri. Prakash Dutta, Officer on Special Duty & Joint Secretary, UD&UHD, Shri. D. J. Jadeja, Chief Town Planner, Town Planning and Valuation Department and other officers for their valuable contribution for the development of the module. I appreciate the efforts of GIDM team especially Shri. Nisarg Dave and Mr. Shubham Daberao along with the Resilience Innovation and Knowledge Academy (RIKA) India team - Ms. Ambika Dabral and Ms. Krishnakali Ghosh.

I sincerely hope that this training module will be useful to trainees, researchers and professionals in urban sector. GIDM remains committed to upholding the standards of excellence and will continue to deliver meaningful educational experiences with the aim of BUILDING RESILIENCE in Gujarat.

(Dr. Rajiv Kumar Gupta)
Director General
Gujarat Institute of Disaster Management

# Abbreviations

| | |
|---|---|
| CBDM | Community-Based Disaster Management |
| CBOs | Community-Based Organisations |
| CCA | Climate Change Adaptation |
| CDMP | City Disaster Management Plan |
| CDP | City Development Plan |
| DM | Disaster Management |
| DRR | Disaster Risk Reduction |
| EbA | Ecosystem-based Adaptation |
| Eco-DRR | Ecosystem-based Disaster Risk Reduction |
| GAR | Global Assessment Report on Disaster Risk Reduction |
| GIDM | Gujarat Institute of Disaster Management |
| GIS | Geographic Information System |
| GSDMA | Gujarat State Disaster Management Authority |
| HFA | Hyogo Framework for Action |
| HRVA | Hazard Risk and Vulnerability Assessment |
| HUDCO | Housing & Urban Development Corporation Ltd |
| ISDR | International Strategy for Disaster Reduction |
| JICA | Japan International Cooperation Agency |
| NAPCC | National Action Plan on Climate Change |
| NBC | National Building Code |
| NbS | Nature based Solutions |
| NDMA | National Disaster Management Authority |
| NGT | National Green Tribunal |
| NIDM | National Institute of Disaster Management |
| NIUA | National Institute of Urban Affairs |
| SAPCC | State Action Plan on Climate Change |
| SFDRR | Sendai Framework for Disaster Risk Reduction |
| TCPO | Town & Country Planning Organization |
| UDA | Urban Development Authority |
| UD & UHD | Urban Development & Urban Housing Department |
| ULB | Urban Local Body |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization |
| UNISDR | United Nations International Strategy for Disaster Reduction |
| UNDRR | United Nations Office for Disaster Risk Reduction |

# Content

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*"Make India disaster resilient across all sectors, achieve substantial and inclusive disaster risk reduction by building local capacities starting with the poor and decreasing significantly the loss of lives, livelihoods, and assets in different forms including economic, physical, social, cultural, and environmental while enhancing the ability to cope with disasters at all levels."* (NDMA, 2019)

The National Disaster Management Authority has formulated a long-term vision based on resilience for India. As the urban population in India increases each year due to economic growth rates in cities, labor requirements, wages, attracting rural-urban migration it is important to strengthen urban systems to cater to the population. Improvement in disaster risk management and building resilience can minimize losses in the future. Achieving urban resilience requires ongoing capacity building as an iterative process of design-application-learning-adjustment. An essential component of capacity building is training. Because of the nature of the work that needs to be done before, during, and after a disaster, training is very important in disaster risk reduction. Climate-related disasters often get exacerbated in cities, majorly due to interactions between urban infrastructure systems, growing urban populations, cultures, and economic activities. Most people find it overwhelming to deal with the speed, scope, and damage of a crisis, which lowers the quality of the response. Thus, it becomes crucial to provide designated responders and risk managers focused training and ensure their capacity building. On the other hand, disaster risk management goes beyond the scope of reaction and calls for better cooperation of all stakeholders across all phases. Increasing complexities of hazards, varied condition of exposure and vulnerabilities have enhanced the need for building resilience. This requires better understanding and training in disaster risk reduction and climate change adaptation to be provided at all levels and to all social groups, including the most vulnerable.

This training module on Urban Risk Reduction and Resilience: A Comprehensive Approach aims to address the vision and support the policy makers and urban practitioners with an ability to prepare for enhancing urban resilience. It has been developed with inputs from key stakeholders from the Urban Development and Urban Housing Department of Government of Gujarat. The ToT model is envisaged to act as multiplier of trainers in the state; thereby creating a self-sustaining process involving knowledge transfer. The module is divided into three parts: Basic Course, Specialized Course for Policymakers, and Specialized Course for Practitioners.

Cities are becoming hotspots of extreme events with increased concentration of people, economic activity, social and cultural interactions, as well as environmental and humanitarian effects. This poses enormous sustainability challenges for housing, infrastructure, basic services, food security, health, education, decent jobs, safety, and natural resources, among other things. The United Nation's Decade of Action highlights the need for urgent action on sustainable development, including in the area of urban resilience. Several SDGs are directly related to urban resilience, including SDG 11, which calls for inclusive, safe, resilient, and sustainable cities. The temperature targets set by Paris Agreement to limit global warming to below 2 degrees Celsius above pre-industrial levels need actions to improve the resilience of urban areas which are vulnerable to the impacts of climate change extreme weather events, and heatwaves.

The number of disasters occurring around the world has increased by a factor of five over the last 5 decades, acerbated by rapid urbanization, extreme weather, and climate change. The Centre for

Research on the Epidemiology of Disasters reports states that around 3.9 billion population was exposed to various natural hazards in the year 2018 (EM-DAT, 2019). It also reports Asian continent is the most vulnerable to hazard events, owing to various factors such as population, location, and so on. In India, the urban population is rapidly increasing with over 34% of the population living in urban areas with a significant proportion of the population living in informal settlements, which lack basic services, such as water, sanitation, and waste management, and are highly vulnerable to disasters and climate impacts. Similar circumstances exist in Gujarat, where 2.57 crore people, or 42.6% of the state's total population, live in urban areas (Census 2011). Gujarat is one of the most urbanized states in India with the urban population increasing from 34 percent in 1991 to 48 percent in 2020.

As rapid urbanization becomes a key driver for the state's economic growth it is essential to have an integrated and accountable urban governance system that can create greener urban footprints, and improve disaster risk management and resilience to climate change. A disaster results in death, property loss, loss of assets and livelihood, as well as destruction and devastation. A proactive, well-coordinated administrative framework is necessary for disaster management, as is a community that is alert, informed, and engaged. Preparing a group of skilled and dedicated employees at all levels may create a proactive, effective, and integrated administrative system. The personnel assisting in a catastrophic situation must draw on their understanding of best practices and intervention techniques. Personnel from Urban Local Bodies (ULBs) will become more aware of the unique demands and activities needed after receiving training on the many manifestations of urban disasters. This training will complement novel frameworks such as SFDRR encouraging building the knowledge of government officials at all levels, and thereby helping in achieving global and national goals. The overall objectives of the training are

- Provide knowledge of urban systems and their resources, resilience, and impacts of climate and disaster risks, and thereby act as a spring for further knowledge multiplication
- Familiarize participants with tools, legislation, and frameworks for the assessment and development of urban resilience
- Infuse informed decisions and systems thinking for improving the quality, efficiency, sustainability, and resilience of urban services
- Improve the readiness of local administrators and stakeholders inter alia increase their knowledge on the key roles and responsibilities to build urban resilience
- Provide participants with the knowledge to formulate effective city development, management plans, and policies for climate change and urban resilience

Trainers in the disaster management and/or urban development sector can employ this training module for providing state and local government officials with training on urban risk reduction and resilience. Professionals in the fields of urban development and disaster management can use the module for independent study as well. The key target users are:

- Officials from departments like Urban Development and Urban Housing Development Department, Town Planning and Valuation Department, Gujarat State Disaster Management Authority, Commissionerate of Relief, etc.
- Practitioners like Engineers, Architects, Planners from autonomous bodies, and urban local bodies (ULBs)
- Policymakers like Chief Officers and Municipal Commissioners
- Elected officials of urban local bodies, and
- NGOs working on urban issues

The Training Module is designed to cater to varied stakeholders and users at the state and local levels in the state of Gujarat. The participants are expected to belong to diverse academic backgrounds, professional fields, and even different nations. Considering their varied level of understanding and familiarity with DRR and CCA, the Training Module offers three types of courses, namely, Basic, Specialized for Policymakers, and Specialized for Practitioners. Each course comprises several training sessions, exercises, and case studies. Tables below provides the overall structure of the Training module detailing the type of courses offered and constituent sessions and learning units under each course. The learning hours of each course are also indicated.

The entire Training Module is divided into three parts namely: Basic, Specialized for Policymakers, and Specialized for Practitioners. This document covers the Basic Course.

## Basic Course

| Day 1 | Day 2 | Day 3 |
|---|---|---|
| **• Introduction to DRM and CCA**<br>• Key concepts in Disaster Risk Management and Climate Change adaptation (60 minutes)<br>• Global frameworks and policies (60 minutes)<br>• Disaster Ethics and Humanitarian Actions (30 minutes)<br>**• Introduction to urban systems, their interdependencies and associated risks**<br>• Risk profile of Gujarat in the urban context (60 Minutes)<br>• Urban systems and associated risks (60 Minutes)<br>• Case study/Group Exercise - Interdependencies of urban systems (60 minutes) | **• Urban Resilience, Framework for Urban Resilience: Case Studies, Methodologies and Tools**<br>• Urban resilience and its components (30 minutes)<br>• Key instruments for urban resilience (60 minutes)<br>• Tools of Resilience Analysis/Assessment (60 minutes)<br>• Group exercise on resilience tool (60 minutes)<br>**• Good Practices in Building Resilient Cities and towns**<br>• Case studies on building resilient towns and cities (60 minutes)<br>• Sectoral experience sharing and group discussion (60 minutes) | **• Urban Resilience and Governance**<br>• Mainstreaming Disaster Risk Management and Climate Change Adaptation into Urban Development Planning (60 minutes)<br>• Multi-sectoral risk management (60 minutes)<br>• Group Exercise – Drafting institutional mechanism for urban risk governance (60 minutes)<br>• Field Visit (120 minutes)<br>• Group discussion (30 mins) |

## Specialized Course for Policymakers

| Day 1 |
|---|
| •**Introduction**<br>  •Role of policymakers in disaster risk management (30 minutes)<br>  •Group activity- Gaps and challenges in urban policies and implementation from lens of DRR and resilience (60 minutes)<br>•**Mainstreaming Disaster Risk Management (DRM) and Climate Change Adaptation (CCA) into Urban Development Planning**<br>  •DRR and CCA frameworks in the urban context (45 minutes)<br>  •Case studies: integration of DRR & CCA through national and state schemes and policies (45minutes)<br>•**Group discussion** (30 mins) |

| Day 2 |
|---|
| •**Transboundary Governance** (30 minutes)<br>•**Disaster Grievance Redressal Mechanism** (30 minutes)<br>•**Disaster Risk Financing**<br>  •Key concepts and existing instruments (30 minutes)<br>  •Group exercise - Tabletop on strategy planning for integration of DRM and CCA (60 minutes) |

## Specialized Course for Practitioners

| Day 1 |
|---|
| •**Introduction**<br>  •Role of practitioners in disaster risk management and resilient urban development (30 minutes)<br>•**Understanding Critical Infrastructure and systemic risk**<br>  •Relevance of critical infrastructures for disaster resilience (30 minutes)<br>  •Risk and Resilience Assessments of Critical Infrastructure and Resilience building (45 minutes)<br>  •Case study- Resilience building measures for Critical Infrastructure (30 minutes)<br>  •Disucssion (15minutes) |

| Day 2 |
|---|
| •**Land Use Planning for Urban Resilience**<br>  •Key concepts and tools (60 Minutes)<br>  •Case studies on application of the tools(30 Minutes)<br><br>•**Grey-Blue-Green Infrastructures for Urban Resilience**<br>  •Key concepts (45 Minutes)<br>  •Introduction to SIA and EIA (30 Minutes)<br>  •Case studies (30 Minutes)<br>  •Discussion (15minutes) |

| Day 3 |
|---|
| •**Technologies for urban resilience**<br>  •Technologies and Application in Urban Planning (60 Minutes)<br>  •Open Data for Urban Resilience (30 Minutes)<br><br>•**Group Exercise** – Scenario-based ward planning (60 minutes) |

The training module is created with a framework that encourages participation. The trainer may take into account the following recommendations in addition to the knowledge and skill inputs described in the technical sessions to make the programme interactive, thorough, and exciting and ensure that trainees retain inputs after the course is over:

- Write a welcome note to the potential participants once the participant list has been finalized. The note should include information on the institute's location, directions to the site, the reporting time for training, the current weather, the required attire, and a warm welcome.
- The participants should be required to complete an online registration form containing their name, address, and contact information, among other information.
- After the training has begun, the list of participants with their contact information should be passed around to check for any errors before being finalized.

- To start a conversation, a group activity involving all participants should be planned as guided in the module.
- Every day, short-duration discussions should be planned, especially for the post-lunch session (no more than 5–10 minutes).
- Change the groups for group projects as often as you can to promote stronger peer interaction.

## Basic Course

The Basic course is an introductory level course. It aims to create a level-playing field for learners belonging to varied sectors and having different levels of understanding and knowledge of DRR and CCA. The course comprises five training sessions with sixteen learning units and has a duration of sixteen hours and thirty minutes. The learners will engage in discussion, field visit, and group exercises.

# Technical Session 1 Introduction to Disaster Risk Management (DRM) and Climate Change Adaptation (CCA)

## Introduction, Overview & Perspectives

The first technical session will introduce learners to the key aspects of understanding disaster and disaster risk, its dimensions (hazards, exposure, vulnerability, and capacity), and other associated terminologies relevant to an urban context. It will highlight the key concepts of, evolving global risk landscape. Further, emphasizing the global shift in focus from disaster management to disaster risk reduction and management, the session will discuss the key global and regional frameworks and strategies such as the Hyogo Framework, Sendai Framework for Disaster Risk Reduction, the 2030 Agenda for Sustainable Development and the New Urban Agenda. The session would further delve into disaster ethics and humanitarian actions and their relevance and application in an urban context.

The learning units of this session are as follows:
- Learning Unit 1.1: Key Concepts in Disaster Risk Management and Climate Change
- Learning Unit 1.2: Key Frameworks and Policies
- Learning Unit 1.3: Disaster Ethics and Humanitarian Actions

The primary objectives of this technical session are:
- To have a better understanding of disaster risks, underlying factors influencing disaster risk
- To be familiarized with basic concepts of disaster risk reduction, and management
- To know about the existing DRR and sustainability frameworks and strategies at the global and regional levels and their relevance in the local context
- To understand and plan ways to practice ethical disaster management and humanitarian actions planning
- To familiarize with relevant global actions and interventions in DRM and CCA

**Duration:** 150 minutes

## Methodology
- Lecture-based learning
- Case study-based learning
- Discussion
- Q&A session

**Trainers' Note**

The first technical session consists of three learning units and should be conducted to provide a basic conceptual clarity about disaster risk reduction and resilience. The trainer should aim for an understanding of each of the concepts covered through the active participation of learners through discussion and question-and-answer sessions. The explanation should be strengthened with as many cases, examples, evidence, and visual aids as possible. While the first technical session is aimed at providing a general understanding of the topic to the learners, it is recommended that while explaining and using case studies, and examples on the same, trainers strive to link the general concepts to the urban contexts of Gujarat. The learners coming from different backgrounds and with varied levels of experience must be brought to a level-playing field of a similar level of clarity of concepts, as these will enable enriching learning and discussions under subsequent technical sessions. The session has been divided into three learning units for ease of understanding.

# Learning Unit 1.1: Key Concepts in Disaster Risk Management and Climate Change

## Brief Description of the Learning Unit

The learners of this course come with diverse expertise and perception of disaster risk management. To develop a uniform understanding of disaster risk management, resilience, and urban development concepts this learning unit would train the learners on the basics of disaster risk reduction and resilience. The learning unit would introduce learners to the key concepts and the phases of disaster (risk) management, actions, and approaches to DRM. It will introduce learners to associated terminologies such as hazards, exposure, vulnerability, capacity, risks, disaster risk reduction, disaster risk management, resilience, and frameworks for urban policy. It will help the learners to gain an understanding of the common language in disaster risk management and underscore their relevance in risk-sensitive development.

## Learning Objectives

- To have an understanding of key terminologies in DRM
- To know the key components of DRR, interlinkages with CCA, and approaches of DRM
- To absorb the interlinkages with an urban policy framework

**Duration:** 60 minutes

## Methodology

- Lecture-based learning
- Discussion
- Q&A session

## Detailed Description

**Disasters** cause a serious disruption of the functioning of a community or a society at any scale. Disasters are the outcome of a complex interaction of hazardous events with the conditions of exposure, the vulnerability of the affected community, infrastructure, assets, and their capacity to cope with the disaster (UNDRR). These can lead to human, material, economic, and environmental losses and impacts. In the last 2 decades, over 7000 disaster events were recorded globally by EM-DAT, one of the foremost international databases of such events. Other than life, and property loss caused by disaster there are many indirect losses such as environmental losses, disruption of social cohesion, and functioning, long-term psycho-social impacts, etc. which are very critical to identify and address.

**Hazard** can be understood as the process, phenomenon, or activity with the potential to cause loss of life, injury or other health impacts, property damage, social, and economic disruption, or environmental degradation (UNDRR). Hazard has the potential to lead to life loss damage, and destruction but not all hazards result in disasters. Their interaction with underlying conditions of exposure, and vulnerability arising out of varied natural, geographic, or anthropogenic factors or a combination thereof cause them to result in disasters. Hazards could be natural, anthropogenic, or socio-natural. They could be single, sequential, or combined in their origin, and effects. During the last decade, and more recently during the COVID-19 pandemic, different parts of the globe have braved various sequential, simultaneous, and cascading occurrences of disaster events. For example, the Morbi bridge accident of 2022, the Bhuj earthquake of 2001 damaged gas pipelines, locusts attacks of 2020 in the Middle East, and South East Asia during the ongoing COVID-19 pandemic, the 2011 East Japan Earthquake, and the Tsunami leading to a nuclear meltdown, etc. The table below describes the major types of hazards as identified by the report 'Hazard Definition & Classification Review '(2020).

*Table 1- Hazards as per 'Hazard Definition & Classification Review' (UNDRR & ISC, 2020)*

| Hazard clusters | Hazards |
|---|---|
| Geo Hazards: having a geological origin caused by an internal geophysical process or near surface process | Earthquakes, Landslides or debris flow, Tsunami (earthquake trigger), Urban fires (during/following volcanic eruption) |
| Meteorological, and hydrological: resulting from the state, and behavior of the Earth's atmosphere, its interaction with the land, and oceans | Lightning, Thunderstorm, Floods (coastal, riverine, flash), Cyclones, Droughts, Ocean acidification, Seawater intrusion, Acid rain, Tornado, Heatwaves, |
| Environmental: arises through the degradation of the natural systems, and ecosystem services | Air pollution, Land degradation, Deforestation, Wildfires, Loss of wetlands, Soil erosion, Coastal erosion |
| Chemical: related to chemicals at the industrial level or otherwise that can have short-term or long-term effects | Heavy metals contamination, Fungicides, Insecticides, Oil pollution, CBRNE (chemical agents) |
| Biological: hazards of organic origin, that can cause significant loss of life, affecting people, flora, and fauna at the population level | Locust, Air-borne diseases, Water-borne diseases, Food-borne diseases, Zoonotic diseases, CBRNE (biological agents), Plague, COVID-19 |
| Technological: includes all technological systems whose damage can lead to socioeconomic problems | Radiation, CBRNE (nuclear agents), Building collapse, Bridge failure, Infrastructure failure, Water supply failure, Power outage, Emergency telecommunications failure, Dam failure, Data security-related hazards, NATECH, Explosions, Leaks, Spills, Mining hazards |

**Exposure** to hazards is an important factor to determine the extent of risk. It is a key determinant in regulating the impact of hazards, as higher exposure to hazards may increase the probability of translating a hazard into a disaster (UNDRR). Populations, infrastructure, and assets located in or closer to hazard-prone areas are more exposed to disaster risks than those who don't. The exposure elements considered in urban areas are building type, critical infrastructure, land use, population and road networks. Identifying the exposure is important to make risk-informed choices for settlement and infrastructure planning in and around the area that is exposed to hazards.

**Vulnerability** refers to the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards (UNDRR). The physical vulnerability relates to tangible aspects including building types, type of roof, type of wall and type of floor. Social vulnerability includes threat to life, ethnicity, children, gender, disability and exists before the occurrence of a disaster however it varies with the exposure to risks and sensitivity of system (Cutter, et al., 2008). Environmental vulnerability pertains to the susceptibility of land and landscape, land-use, existing ecological settings including natural resources and ecosystem services. Economic vulnerability includes probable financial losses held to occupation, income, funds, gross domestic product of a country etc. Systemic vulnerability represents vulnerability resulting due to inefficient and ineffective governance and administration and is one of the most important in understanding the impact of disasters on urban systems. Vulnerabilities in urban areas are enhanced due to inadequate local governance where departments work in silos, environmental degradation, and the overstretching of resources.

**Capacity** is considered the combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience. Capacity includes not only knowledge and skills but also the availability of resources, robust infrastructure, institutions, services, social relationships, and leadership, among others. **Coping capacity** is the ability of people, organizations, and systems, using available skills and resources, to manage adverse conditions, risks or disasters. The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during disasters or adverse conditions. Coping capacities contribute to the reduction of disaster risks. Capacity is a major influencing factor of disaster risk, which is defined as the skills of people, organizations and systems, using available expertise and resources, to face and manage the adverse impacts of a hazard.

**Disaster risk** is defined as potential loss of life, injury, or destroyed or damaged assets that could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity (UNDRR). Risks in urban areas depend on the location, associated exposure to different hazardous conditions and underlying socio-economic, physical and environmental conditions of communities, infrastructure and assets. For example, a migrated family with low income tends to live in squatters near hazardous areas where rent is low. Systemic risks are the risks embedded in a system with a cumulative potential to trigger collapse/adversely impact the functioning of the system. These are caused by stressors (challenges caused or exacerbated by disasters) such as environmental degradation, heat stress, inadequate disease surveillance, inadequate regulations, etc. are slow onset and often go unnoticed. However, these have the potential to negatively affect overall system performance when some characteristics of the system change, often seen as a tipping point. Some of the mitigating factors of systemic risk are ethical consumption, long-term public planning, social nets and coverage, ecosystem-based solutions, etc. (UNDRR 2019).
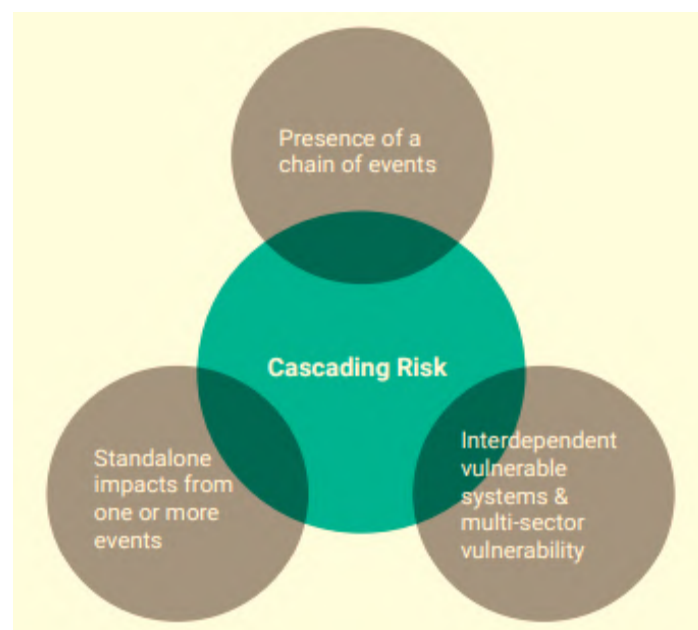


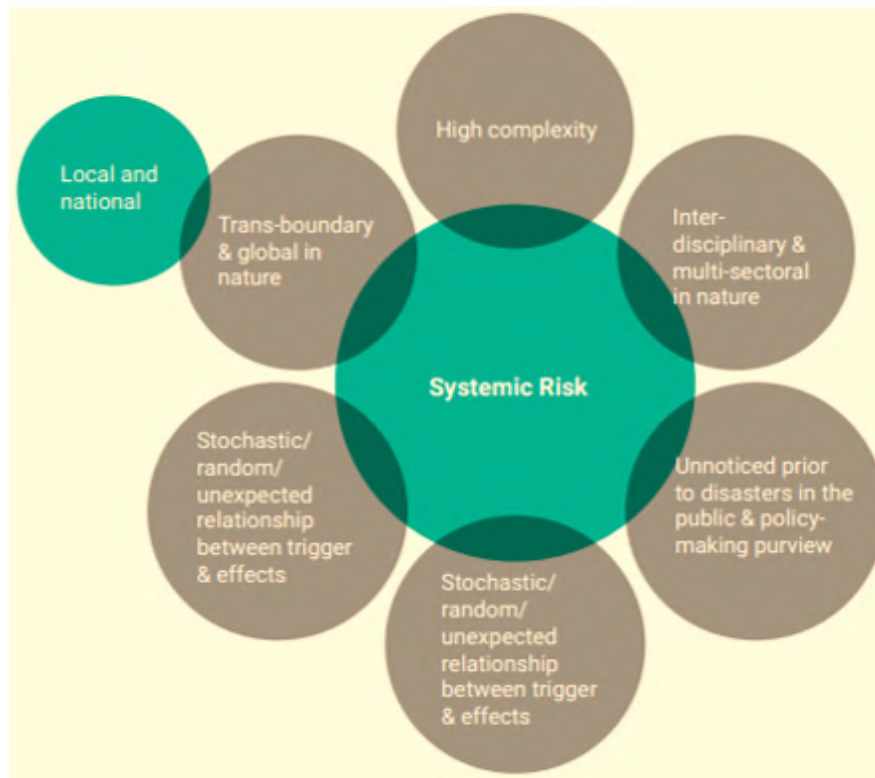*Fig 1. Key Characteristics of Cascading Risks (UNDRR, 2021)*

*Fig 2. Key Characteristics of Systemic Risks (UNDRR, 2021)*

**Compound risks** are the risks associated with multiple hazard events that can occur simultaneously or successively. These are usually amplified by background conditions e.g. heatwaves of 2020 in Northern India highlight the compounding effect of heatwaves and locust attacks in a pandemic-stricken situation. Droughts and wildfires often occur together and can be identified as compound risks like the wildfire observed in the Nakhatrana region in 2020. **The cascading** impacts are observed in many disaster events where the crises are exacerbated by the damage and failure of systems. To understand cascading risks, it is essential to undertake chronological pattern identification to predict the next impact that is likely to take place Cascading events may begin in small areas but can intensify and spread to influence larger areas. E.g. Baghjan oil and gas leak in 2020 that led to forest fire, soil and water contamination and huge biodiversity loss, when a community is evacuated as a result of a hazardous materials leak from the industry like the Bhopal Gas Tragedy, and a nearby stream is contaminated, these are also cascading disasters. Parts of Gujarat lie in seismic zone V in addition, it has many accident-prone industrial units thus increasing the chances of NATECH (Natural Hazards Triggering Technological Accidents) disasters.

NATECH refers to the interaction between natural hazards and industrial accidents. Natural hazards create a primary vulnerable condition and additionally contribute to originating effects of secondary hazards which gradually become the root cause of hazards like industrial pollution, nuclear radiation, toxic wastes, dam collapses, transportation accidents, fire, toxic release, chemical spillage, etc. They significantly add to the burden of the stakeholders already harmed with the effects of the triggering natural hazard (UNDRR, 2019). A prominent NATECH disaster in India was the Chasnalla mine disaster of 1975 which killed 375 people due to flooding in mines.

**Disaster Risk Reduction** aims at preventing new, reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development. The difference between disaster management and disaster risk reduction is that the former thrusts more on the preparedness for response and recovery while the latter focuses on

all aspects with similar or more thrust on prevention and mitigation of disaster risk rather than of disasters. The conceptual framework of DRR focuses on the prevention of new risk, reduction of existing risk and preparing for better management of residual risk through a conceptual cyclic process of risk-informed development planning and disaster management (of residual risk).



*Fig 3. Conceptual Framework of DRR (GIDM, 2020)*

**Disaster Risk Management** is the application of disaster risk reduction policies and strategies to prevent new disaster risks, reduce existing disaster risks and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses (UNDRR). An integral part of disaster risk management is the development of national-level plans, sub-national plans, and local level plans and laying down institutional and financial mechanisms along with roles & responsibilities of key stakeholders for the management of risk.

Some of the key DRM approaches include the following:

- All-of-hazards approach: promotes an understanding of holistic hazard risk including the systemic and complex nature of risk
- Whole-of-society approach: collective responsibility of DRR on the shoulders of all
- Whole-of-government and multi-sectoral approach of DRR planning to mainstream DRR in sectoral and departmental planning at all levels

*Fig 4: Types of DRM Actions (Earth Shaker PH, 2021)*

To make a robust disaster risk management mechanism all three types of DRM actions are necessary. E.g. In Gujarat, post the Bhuj earthquake, the government designated the Gujarat Urban Development Company Limited (GUDC) as the implementing agency for conceptualizing and implementing urban development projects. The government additionally, decided to hire consultants for town planning and infrastructure planning and to scrutinize applications for building permissions. The government decided to utilize statutory town planning mechanisms such as development plans. A series of studies were undertaken to assess the hazard risks and incorporate them into the plan. The government appointed town planning officials to get the plans adopted by the community and rectify mistakes, if any. This also ensured continuity on decision-making. The government also focussed on maintaining accurate maps in all cities and provided finances to the affected population.

***Discuss with learners:*** *List some disaster management activities in urban areas and how have they prevented loss or damage to assets in the past.*

"Change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable periods of time" (UNFCCC, 1992). **Climate change** is considered to increase disaster risk in a variety of ways - by altering the frequency and intensity of hazard events, affecting vulnerability to hazards, and changing exposure patterns. Climate change in rural and urban areas is linked with the aspects of migration and availability of resources and vulnerability of livelihoods. Fig 4 illustrates an impact chain that conceptualizes the influence of climate change, disasters and development on each other. **Climate change adaptation** refers to the process of adjusting to current or expected climate change and its effects (IPCC, 2014). It includes actions undertaken that reduce the negative impact of climate change while taking advantage of potential new opportunities. It involves adjusting policies and actions because of observed or expected changes in climate.



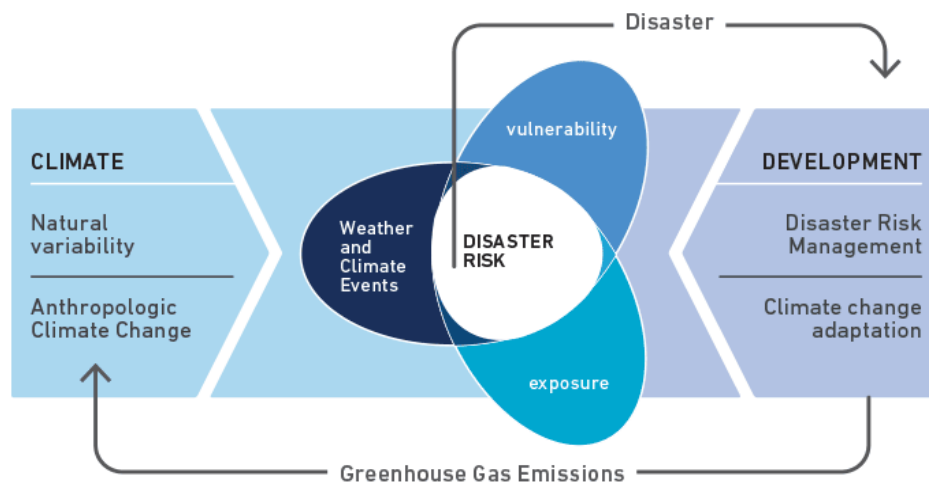Video: UN Report charts huge rise in climate disasters by UNDRR **https://www.youtube.com/watch?v=xH5tgFGw1e4&t=3s**

*Fig 5. The Impact Chain between Climate, Disasters and Development (IPCC, 2012)*

**Resilience** is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management (UNDRR). Recovery, rehabilitation and reconstruction phases after a disaster are intended to increase the resilience of nations and communities through integrating disaster risk reduction actions into the restoration of physical infrastructure and societal systems, and into the revitalization of livelihoods, economies and the environment defines the concept of "Build Back Better".

The DRM strategies and approaches are ever-evolving in nature. Since the 1960s, many countries have established national emergency committees or commissions to respond to disaster events; however, less focus has been given to preventing the root causes leading to such disasters. Researchers identified that the vulnerability of an area is linked to inherent characteristics of socio-economic systems which can be further impacted due to disasters. Actions targeting all phases of DM such as prevention, mitigation, preparedness, etc. can be considered an integrated form of risk management. The Yokohama Strategy for a Safer World emanated in 1994 and provided landmark guidance to governments concerning the adoption of risk management practices as a means to reduce the impacts of disasters (Villagrán de León 2008). It led countries to modify policies along the lines of risk management.

A business-wide strategy for managing risk is called Integrated Risk Management (IRM). It is feasible when all sectors and stakeholders are involved, and the emphasis is on minimizing risk as an essential component of the strategy. Through an integrated view of how well an organisation manages its particular set of risks, it enhances decision-making and performance. Every activity carries a certain amount of risk, so IRM incorporates risk analyses and mitigation plans into every facet of the organisation. Operational risk, enterprise/strategic risk, and technology/cyber risk are all included. Senior management must consistently and vociferously support it, and effective teamwork is essential to its success. Two of the prominent integrated risk management frameworks thus established were: the GIRO framework and the IRGC risk governance framework. These frameworks are different in approach with consideration to root cause analysis, various phases of disaster, are suitable for aspects of precautions, engineering, mitigation, etc. and assigning roles to stakeholder groups.

***Discuss with learners:*** *List a few examples from your jurisdiction with shifts in the social, political, economic and cultural trends, after disasters that can imply the recognition and precise assessment of hazards to design and enact regulations for long-term gains.*

The GIRO framework for integrated risk management considers the underlying risk factors and attempts to minimize them. It considers that the generation of risks is an interdisciplinary process and has features as following as depicted in the figure:

- Design and implementation of measures targeting risk minimization and restraining new risk creation
- Risk management is incorporated by communities or societies which have suffered a major disaster.
- Risk management has to be based on the systematization of the root causes that have led to the generation of such risks or their increase.
- Identification of actors (citizens, governments, civil society, private sector) as responsible for the generation of risks and the scenario/setting which surrounds these actors plays a crucial role in prompting actors to carry out actions in certain ways which unfortunately generate risks
- Disasters and risks can be separated in the time domain

The GIRO conceptual framework refers to three components: the Domain of the Setting, the Domain of Risks and the Domain of Disasters. The domain of the Setting includes policies, norms, rules, regulations, trends, and traditions to which the actors are exposed and are associated with social, political, institutional, economic, and environmental conditions present in societies. Eg. Government may decide for undertaking infrastructure development on a hazard-prone land without contemplating future vulnerabilities. These decisions are dictated by spheres of influence like economic policies, local norms etc. The Domain of Risks covers the components of risks (hazard, vulnerability, exposure) as well as those conditions which may give rise to additional risks. These are dictated by the decisions made by actors. Finally, the Domain of Disasters is characterized in terms of impacts produced by the event triggered.
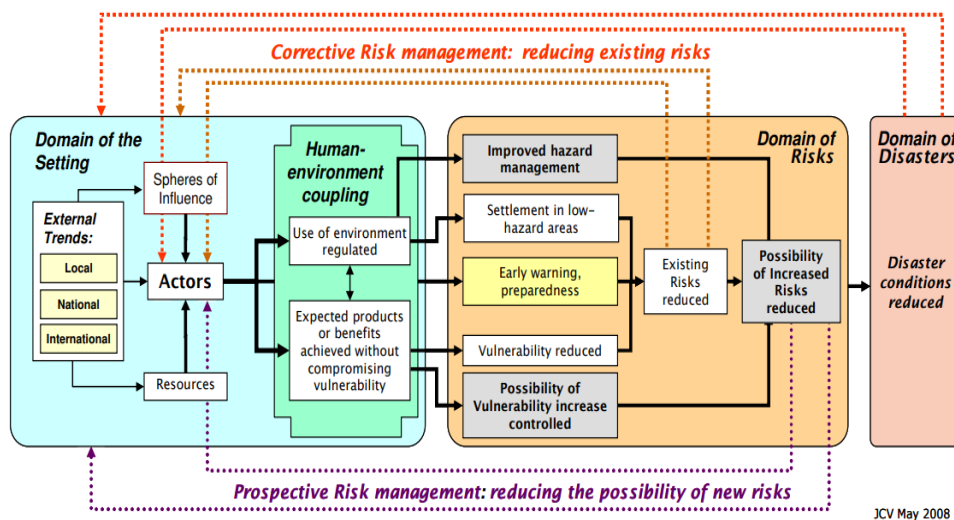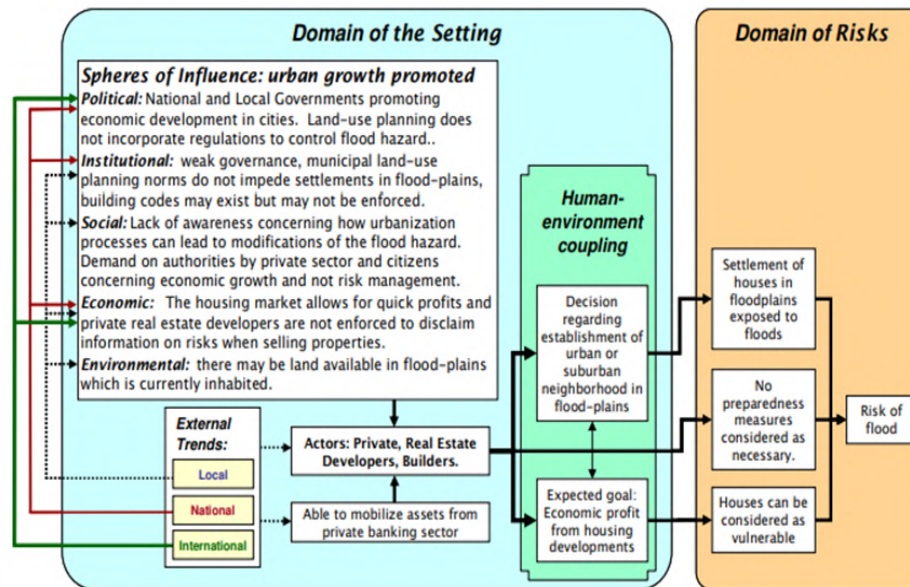
*Fig 6. The GIRO Framework and Example Based on Flooding Scenario (Villagrán de León, 2008)*

IRGC Risk governance framework guides early identification and handling of risks involving multiple stakeholders. As risk is mostly managed on a sectoral or thematic basis, by individual government agencies there are not many holistic actions and mapped interdependencies across sectors. This framework recommends an inclusive approach to frame, assess, evaluate, manage and communicate important risk issues that are marked by complexity, uncertainty and ambiguity. The IRGC Risk Governance framework takes a multidisciplinary and multistakeholder approach to DRM where it tries to address negative and unintended consequences of a risk in addition to the anticipated risks. It depends on three cross-cutting aspects of communication, stakeholder engagement and context.
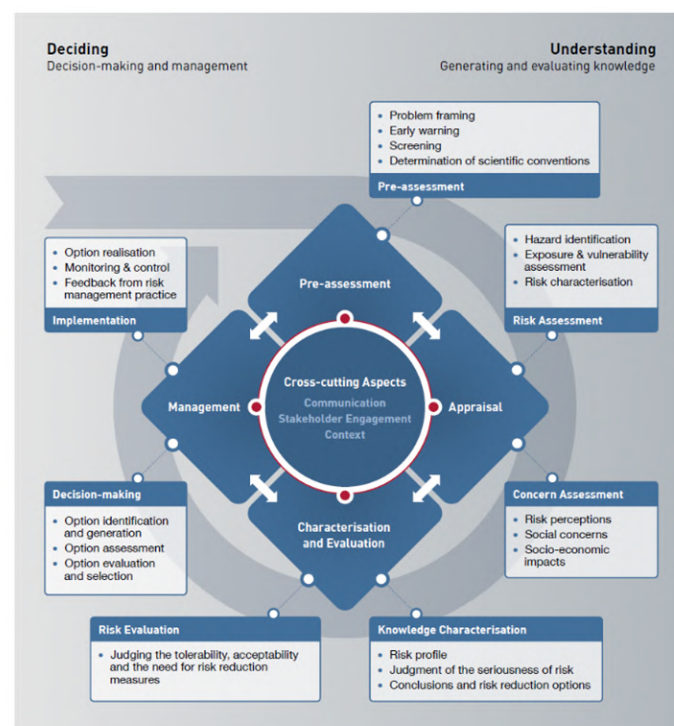


*Fig 7. IRGC Risk Governance Framework (EPFL)*

The key elements of the framework are as follows:

- Pre-assessment – Identification and framing; acknowledging rules or processes and setting the boundaries of the risk or system.
- Appraisal –Includes knowledge about the physical, economic and social impacts of technologies, and causes and consequences of risks.
- Characterization and evaluation – risk evaluation and identification of ways to manage it.
- Management – Deciding on and implementing risk management options relying on evidence-based knowledge This should be done by establishing the two-way dialogue
- Cross-cutting aspects Include communication, engaging with stakeholders, and considering the context. It reflects the need to deal with risk in a way that accounts for the societal context of both the risk and the decision about it.

This specific framework distinguishes between understanding risk and deciding what to do about risk. This distinction reflects the separation of responsibilities for risk appraisal and management as a way of maximizing the accountability of all involved activities.

The Town Planning Scheme used in Gujarat is to pool together the land (typically between 100 and 200 hectares) that is currently under various ownerships and redistribute it in a properly reconstituted form after removing the necessary space for open spaces, social infrastructure, services, housing for the economically disadvantaged population, and the road network. In this approach, a group of landowners is temporarily brought together by the public planning agency or development authority for planning purposes under the auspices of the state-level town or urban planning statute. This procedure allows the development authority positive control over the layout and development of the peri-urban area while allowing it to develop land without entirely purchasing it. It was applied after the Bhuj earthquake for rehabilitation. It holds potential for core area revitalization which has not been explored much.

Draft Development Plan, 2041 prepared by the Town and Country Planning Department, Himachal Pradesh was challenged in court for violating the NGT Act by National Green Tribunal (NGT). Violations like permission for the construction of more floors, new constructions in the core area, constructions in the green area, and permitting development in sinking and sliding areas were observed. Despite the promotion of the vertical density of residential units by NITI Aayog and MoHUA, the vulnerabilities of the core areas were given higher consideration, and height restrictions were applied by the NGT.

***Discuss with learners:*** *What could be some key entry points for robust risk governance in development plans?*

**Session Plan**

| Content | Trainer's Note | Time |
|---|---|---|
| Concepts of DM – Hazard, Vulnerability, Capacity, Risk, Risk Reduction | Focus on explaining the types of hazards, and and vulnerabilities with a a focus on the urban context. | 25 min |
| DRM strategies and actions, GIRO framework | Detail out the DRM strategies and actions and relevant frameworks in urban policy. | 25 min |
| Discussion | A discussion on some of the key learning focusing on hazards, vulnerabilities, DRM, urban policy etc | 10 min |

**References**
- Introduction to Disaster Risk Reduction https://www.preventionweb.net/files/26081_kp1concepdisasterrisk1.pdf
- Hazard Terminology, United Nations Office for Disaster Risk Reduction

https://www.undrr.org/terminology/hazard
- UNGA Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction https://www.preventionweb.net/files/50683_oiewgreportenglish.pdf
- Cutter, S. L. et al., 2008. A place-based model for understanding community resilience to natural disasters. *Global Environmental Change,* 18(4), pp. 598-606.
- Villagrán de León, Juan Carlos (2008). GIRO: the integral risk management framework an overview. UNU-EHS Working Paper. UNU- EHS.

**Additional reading material**
- GIRO: The Integral Risk Management Framework: An overview
  http://collections.unu.edu/view/UNU:1895#viewAttachments
- Introduction to the IRGC risk governance framework
  https://www.epfl.ch/research/domains/irgc/concepts-and-frameworks/risk-governance-framework/#:~:text=The%20IRGC%20Risk%20governance%20framework,by%20complexity%2C%20uncertainty%20and%20ambiguity.
- Sound Practices of Disaster Risk Reduction at Local Level
  https://www.sciencedirect.com/science/article/pii/S1877705818301760.

**Notes**

**Notes**

# Learning Unit 1.2: Key Frameworks and Policies

## Brief Description of the Learning Unit

The learning unit on key frameworks and policies introduces the learners to the current global, national and sub-national DRR policy landscape. Continuing from the DRM strategies in the previous learning unit, this learning unit will provide learners with a broad view of how the DRR narratives, frameworks and strategies at the global and national levels have evolved and the influence these frameworks have made at the sub-national level. In addition, it would set the context for subsequent technical sessions and learning units which refer to the principles, priorities, and actions envisaged in these frameworks and policies.

## Learning Objectives

- To understand the temporal evolution of key development relating to DRR
- To be familiar with the existing DRR frameworks, policies and priorities

## Duration: 60 minutes

### Methodology

- Lecture-based learning
- Discussion
- Q&A session

## Detailed Description

The increasing understanding of the complex and systemic nature of risk has led to an end to the era of hazard-by-hazard risk reduction. The global DRR frameworks have been integral in steering the priorities of DRR action across levels. In the last 30 years, the global focus and commitment to the field of DRR can be traced back to the marking of 1990-1999 as the **International Decade of *Natural* Disaster Reduction** (IDNDR). The objective of the IDNDR was to "reduce, through concerted international action, especially in developing countries, the loss of life, property damage and social and economic disruption caused by *natural* disasters." The end of IDNDR led to the creation of an inter-agency task force and inter-agency-secretariat for disaster reduction in 2000, under the direct authority of the Under-Secretary-General for Humanitarian Affairs, namely the UNISDR (United Nations Intern Strategy for Disaster Reduction). The UNISDR is now known as UNDRR (United Nations Office of Disaster Risk Reduction). As the frequency and changing patterns of disasters are ever-increasing with floods and storm-related events having increased in number compared to other hazard events in both the decades from 1980 to 2000s, risk reduction has become a global focus.
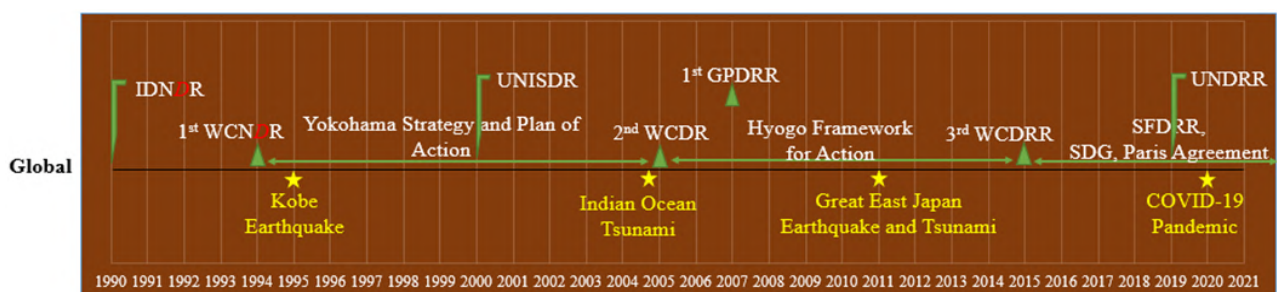


*Fig 1. Key Evolution and Events in DRR*

The 3 World Conferences in 1994, 2005 and 2015 respectively resulted in the Yokohama Strategy and Plan of Action (1994-2004), Hyogo Framework of Action (2005-2015) and Sendai Framework for Disaster Risk Reduction (2015-2030). A major focus during the period till the end of the 90s has

been on the reduction of natural disasters, a term which we no more endorse now, with the better realization that no disaster is natural. In addition, these years saw the paradigm shift from a reactive to a proactive approach to DRR. **Yokohama Strategy and Plan of Action** considered the linkage of disaster management action to development. A global blueprint for disaster risk reduction was developed by the ʻ**Hyogo Framework for Action** ʼ**(HFA)** in Kobe, Hyogo, Japan (January 2005) whereby its priority 4 called for reducing risk and the underlying risk factors. Linking this to the urban context, it becomes very crucial to identify and understand the underlying risk factors in the urban areas, systems and services to be able to reduce the associated risks and ensure effective functioning of these systems and services.
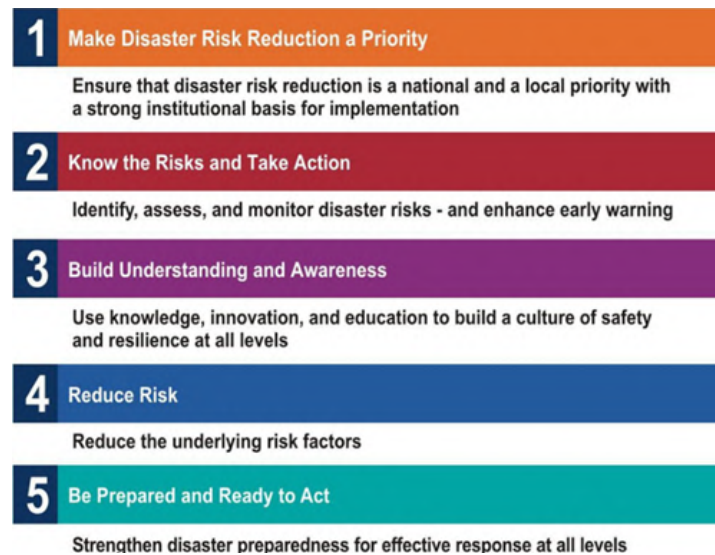


**1** Make Disaster Risk Reduction a Priority

Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation

**2** Know the Risks and Take Action

Identify, assess, and monitor disaster risks - and enhance early warning

**3** Build Understanding and Awareness

Use knowledge, innovation, and education to build a culture of safety and resilience at all levels

**4** Reduce Risk

Reduce the underlying risk factors

**5** Be Prepared and Ready to Act

Strengthen disaster preparedness for effective response at all levels

*Fig 2. Priorities of Hyogo Framework (UNISDR, 2005)*

**Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR)**, the successor to the HFA was signed at the Third UN World Conference in Sendai, Japan, on March 18, 2015. SFDRR is built on components that ensure continuity with the work done by States and other stakeholders under the HFA and introduce several innovations as called for during the consultations and negotiations. SFDRR recognizes that DRR requires empowerment and inclusive, accessible and non-discriminatory participation, paying special attention to people disproportionately affected by disasters, especially the poorest. Along with the Sendai Framework, global leaders have brought forth the 2030 Agenda for Sustainable Development and the Paris Climate Agreement. SFDRR along with its expected outcome of not only substantially reducing the disaster losses has also considered reducing disaster risk. The target G of SFDRR as shown in the figure has shifted the focus from disaster management to disaster risk reduction and risk management. To achieve this outcome, the goal of SFDRR underscores on prevention of new risks, reduction of existing risks and preparation for residual risks; thereby strengthening resilience. The measures envisaged for doing so include economic, structural, legal, social, health, cultural, educational, environmental, technological, political, and institutional. The priorities of action laid down under the SFDRR were:

- Understanding disaster risk;
- Strengthening disaster risk governance to manage disaster risk;
- Investing in disaster reduction for resilience and;
- Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction.
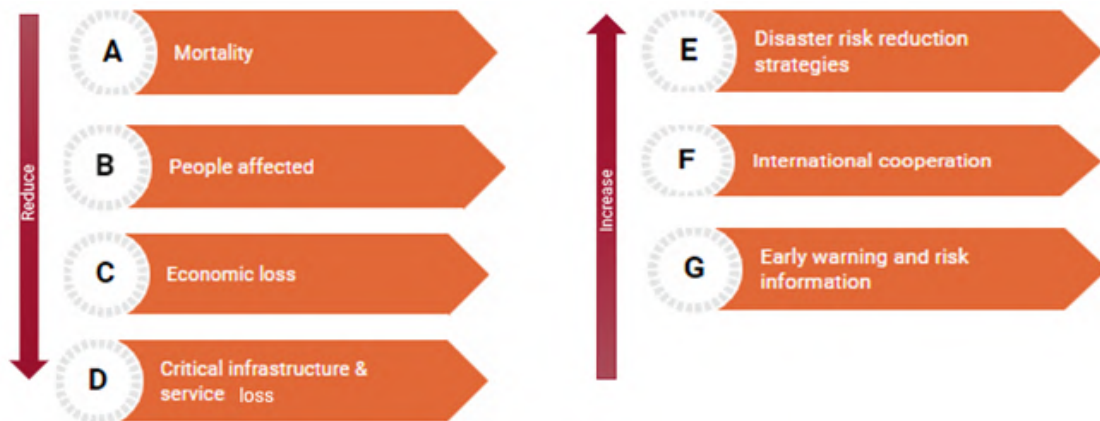
*Fig 3. Seven Targets of the Sendai Framework*

**SFDRR in the Urban Context**

Under Priority 2, SFDRR mentions national and local governments to encourage the establishment of necessary mechanisms and incentives to ensure high levels of compliance with the existing safety-enhancing provisions of sectoral laws and regulations, including those addressing land use and urban planning, building codes, environmental and resource management and health and safety standards, and update them, where needed, to ensure an adequate focus on disaster risk management.

Under Priority 3, to promote the mainstreaming of disaster risk assessments into land-use policy development and implementation, including urban planning, land degradation assessments.

In November 2016, the **Paris Agreement** was brought into force. It is a legally binding international treaty on climate change that was adopted by 196 countries at the UN Climate Change Conference (COP21). The targets of the agreement are to limit the temperature increase to 1.5°C and decline greenhouse gas emissions by 43% by 2030. It thrives on economic and social transformation by governments to bring increasingly ambitious climate action. Countries submit their national climate action plans, known as nationally determined contributions (NDCs) to reflect an increasingly higher degree of ambition with actions on establishing carbon neutrality targets and promoting zero-carbon solutions, finance climate change adaptations and capacity building.

It is crucial to identify opportunities and challenges in integrating DRR and resilience building into development plans to achieve sustainable development. The **2030 Agenda for Sustainable Development** is a plan of action for people, the planet, prosperity, peace and partnership. It envisages a world with universal respect for human rights and dignity, rule of law, justice, equality, and non-discrimination; respect for race, ethnicity and cultural diversity and of equal opportunity, permitting the full realization of human potential and contributing to shared prosperity. It strives to revitalize global, regional, national and local actions and collaborations for undertaking bold and transformative steps for ensuring a sustainable and resilient development journey ahead. The Agenda lays down 17 Sustainable Development Goals (SDGs) and 169 associated targets. The SDGs are built on the Millennium Development Goals. SDGs envisage a world: Free of poverty, hunger, disease, fear, and violence; with equitable and universal access to education, health care, social protection, safe drinking water, and sanitation; with safe, resilient and sustainable human habitat; with universal access to affordable, reliable and sustainable energy. As policy integration has been used by policymakers for many decades and efforts have been undertaken to better understand integration, integration of SFDRR with SDG holds potential for a resilient future. The direct points of convergence can be noticed between different targets and 3 of the SDGs, namely,

- SDG 1- Target 1.5: By 2030, building the resilience of poor and vulnerable sections and reducing

their exposure and vulnerability to climate-related extreme events and other socio-economic and environmental shocks.

- SDG 11-Target 11.5: By 2030, significantly reducing disaster mortality and number of affected people, direct economic losses due to disasters, including water-related disasters; with a focus on protecting the poor and vulnerable.
- SDG 11-Target 11b: By 2020, substantially increasing the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation of climate change, and resilience to disasters.
- SDG 13-Target 13.1: Strengthening resilience and adaptive capacity to climate-related hazards in all countries.



*Fig 4. Some Areas of Convergence of SFDRR and SDGs (UNDRR)*

United Nations Office for DRR launched the **Making Cities Resilient Global Campaign** in 2010 intending to achieve sustainable urbanization while addressing issues of local governance and urban risk. The campaign identifies **local governments are key targets for building urban resilience**. They benefit from urban risk reduction by developing effective policies and tools to meet future risks and development goals. The ten essentials as shown in Figure 5 are the critical and independent steps that need to be undertaken to build urban resilience. The key components of the campaign would be elaborated in Technical Session 5.

| 1 | Organise for disaster resilience |
| 2 | Identify, understand and use current and future risk scenarios |
| 3 | Strengthen financial capacity for resilience |
| 4 | Pursue resilient urban development and design |
| 5 | Safeguard natural buffer to enhance the protective functions offered by natural ecosystems |
| 6 | Strengthen institutional capacity for resilience |
| 7 | Understand and strengthen societal capacity for resilience |
| 8 | Increase infrastructure resilience |
| 9 | Ensure effective disaster response |
| 10 | Expedite recovery and build better |

*Fig 5. Ten Essentials for Making Cities Resilient (UNDRR, 2017)*

The **New Urban Agenda** offers a paradigm shift based on the science of cities and lays out standards and principles for the planning, development, management and improvement of urban areas. It works to accelerate Sustainable Development Goals (SDGs), particularly SDG 11– Make cities and human settlements inclusive, safe, resilient and sustainable. It includes 4 dimensions under which it calls for integrating disaster risk reduction and climate change adaptation and mitigation considerations and measures into age- and gender-responsive urban and territorial development and planning. It encourages actions to introduce natural elements into plans for the built environment. The New Urban Agenda and its key dimensions relevant to urban resilience would be discussed in detail in Technical Session 5.

An example of actions in Gujarat that align with the New Urban Agenda was in Ahmedabad, where a wall was built along the river Sabarmati to prevent floods and protect the environment from degradation. It allowed developing new streets, parks, and development of other civic amenities including a promenade along the river.

*Discuss with learners: List practices from your city that build urban resilience.*



**Learn more about the New Urban Agenda**
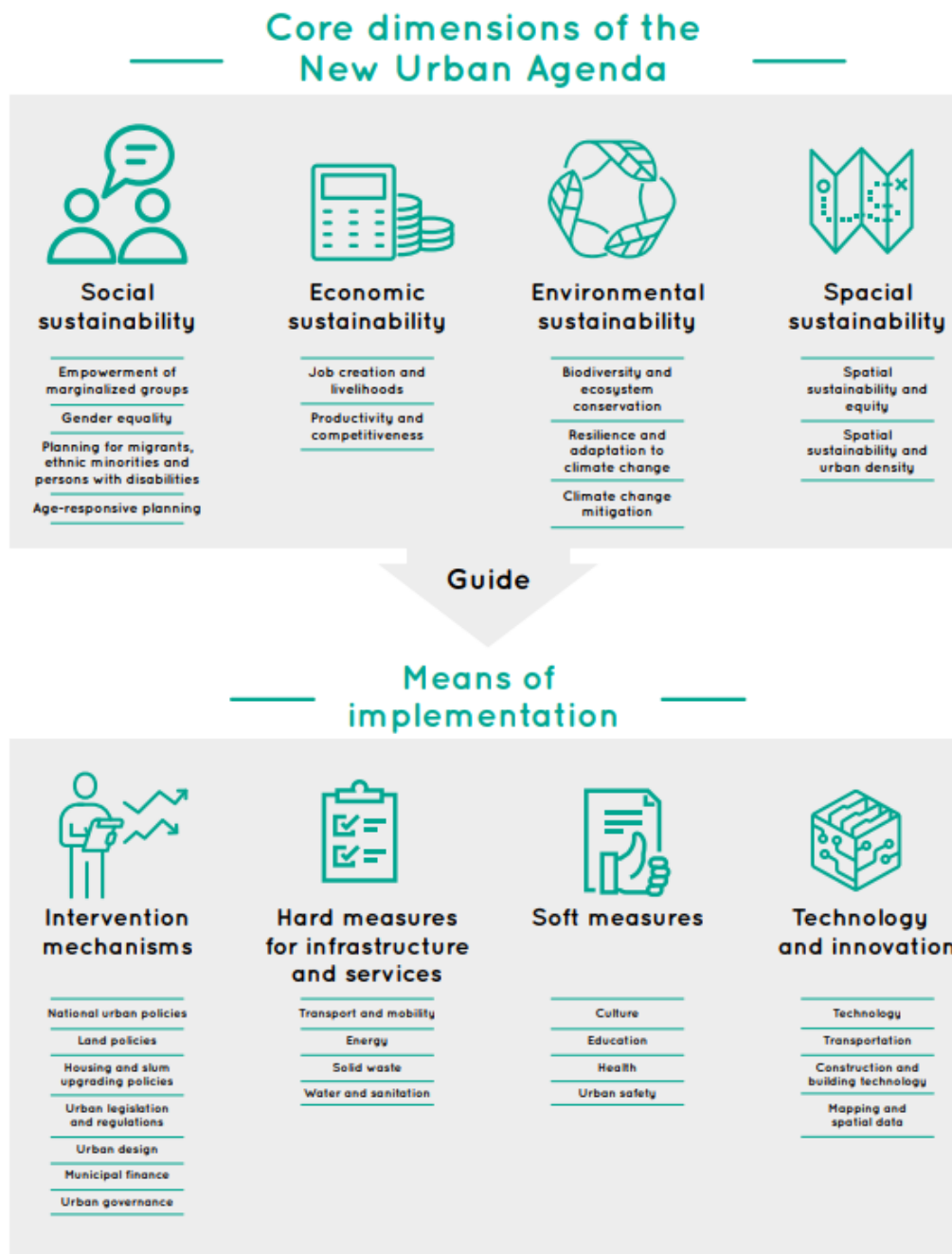
*Fig 6. Core Dimensions of New Urban Agenda (UN-Habitat, 2020)*

UNDRR mandated the development of the **Global Risk Assessment Framework (GRAF)** to support the achievements of SFDRR and the 2030 Urban Agenda for Sustainable Development. It was envisioned to undertake risk-informed decision-making and alter behaviors, concerning complex and systemic risks. It was designed with reference to Global Risk Model developed for Global Assessment Reports (GAR 2019) on Disaster Risk Reduction and covered a wider range of risks including slow onset disasters. In the wake of recent events related to global pandemics, it was realized that a shift from managing conventional hazards to engineering an enhanced understanding of the dynamic interactions with systemic risks is required. This strengthened the need for frameworks like GRAF that can support more resilient development and humanitarian planning. Among other activities, the GRAF focuses on developing methods for understanding and depicting the levers and drivers of risk and associated potential tipping points.

*Fig 7. Key Pillars of GRAF (UNDRR)*

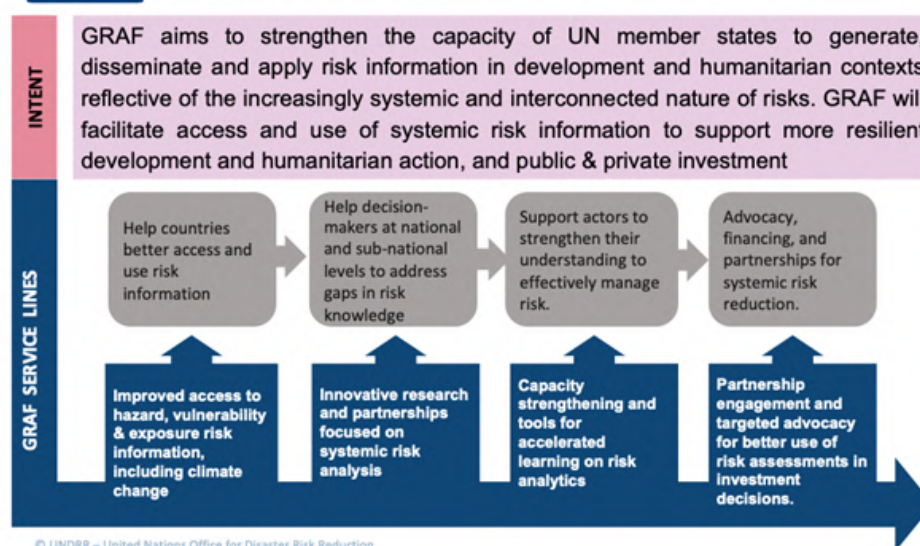India is one of the most disaster-prone countries in the world with several states having faced severe disaster situations. Due to its vastness, the country requires building a robust information database to inform land use and risk-informed infrastructure development at all levels. The National Disaster Management Authority (NDMA), established under the **Disaster Management Act in 2005**, serves as the main organization coordinating and governing all disaster-related activities. Its vision is to build a safer and resilient India through holistic, proactive and technology-driven development which involves all stakeholders to build a culture of prevention and preparedness (CFE-DM, 2018). The National Disaster Management Plan was released and revised in 2016 and 2019, respectively to align the institutional frameworks and mechanisms with the Sendai Framework for Disaster Risk Reduction (SFDRR) and Sustainable Development Goals. Some of the national-level plans and policies for DRR are shared in the table below.

In an urban context, the consideration of frameworks and policies are reflected in building bye-laws, zoning regulations, guidelines and codes. Governance is administered by these instruments, for ensuring public safety and equitable development. To incorporate the provisions of the legal and policy guidelines, best practices of the States and the planning systems Urban and Regional Development Plans Formulation and Implementation Guidelines (URDPFI) were conceptualized. As at the local level, the Municipal Authorities and Panchayat regulate the development/ construction of buildings the conditions of location may vary thus these guidelines should be referenced for the building regulation and planning.

*Table 1. India's Legislative Plans and Policies Intended to Improve Disaster Risk Reduction And Climate Resilience (NDMA, 2020)*

| Implementation | Plan/Policy | Scope | Purpose |
|---|---|---|---|
| National Disaster Management Authority | Disaster Management Act (2005) | National, State, Union Territories, Districts | The legal foundation for disaster-related activities. Includes provision for disaster preparedness, mitigation, and risk reduction to be implemented at government levels |
| National Disaster Management Authority | National Policy on Disaster Management | National, State, Union Territories, Districts | Expanding the scope of disaster management activities to build a resilient and safe India through proactive and holistic |

| Implementation | Plan/Policy | Scope | Purpose |
|---|---|---|---|
| | (2009) | | multi-hazard strategy, in consideration of cooperation, partnership, and technological interventions. |
| National Disaster Management Authority | National Disaster Management Plan (2019) | National, State, Union Territories, Districts | Framework and direction for all government agencies to mainstream responsibilities and intervention strategies with consideration to all phases of the DM cycle. Founded on the DM Act and NPDM 2009, and integrates mandates from SFDRR, SDG and Paris Agreement. |
| Prime Minister's Council on Climate Change, Relevant Stakeholders | National Action Plan on Climate Change (2008) | Whole-of-society | Incorporates vision for ecologically sustainable and green development in all of the national development domains from industry to agriculture, urban spaces and ecological systems |
| Gujarat State Disaster Management Authority | Gujarat State Disaster Management Act (2003) | State, Districts of Gujarat | Provides for effective management of disasters in all phases of disaster management i.e. mitigation, relief, reconstruction and rehabilitation by clarifying the roles of principal entities in disaster management. Engages for mitigation of effects, for administering emergency relief during and after disasters and for implementing, monitoring and coordinating measures for reconstruction and rehabilitation in the aftermath. |
| Climate Change Department, Govt. of Gujarat | State Action Plan on Climate Change (2014) | Gujarat state | Includes generating strategic knowledge for informed decision-making, creating public awareness and education and empowering communities for participatory and decentralized action on climate change. |

Post the 2001 Gujarat earthquake, the **Gujarat Disaster Management Act, 2003** came to force to provide for effective management of disasters, for mitigation and administering emergency relief and for implementation, monitoring and coordinating measures for reconstruction and rehabilitation in the aftermath of disasters. Gujarat State Disaster Management Authority (GSDMA) was formed to strengthen disaster management capacities and promote an integrated and coordinated system of disaster management in Gujarat according to section 7 of the act. GSDMA conducted a study on "Review of Building Codes and Preparation of Handbook and Commentary" after the earthquake and it was established that existing Building codes were insufficient for hazard conditions of earthquakes, cyclones and fire. According to the act the GSDMA was expected to develop a State Disaster Management Plan to streamline disaster management in the state while keeping in consideration the hazard profile and disaster history of the state.

Some of the urban development policies and schemes that contribute to improving the resilience of urban areas are:

**Urban Community Development Programme, 1958** led Urban Community Development Projects in Delhi, Ahmedabad (l962), Baroda (1965) and Calcutta (1966) Projects. It undertook an urban community development programme and made interventions about the lines on which urban mohalla-level (neighbourhood-level) actions were undertaken. It considered staffing pattern of a Project Officer and 8 Community Organisers supported by some voluntary workers for local

developmental activities undertaken by the neighbourhood community.

**Constitution (Seventy Fourth) Amendment Act, 1992** promoted a decentralized mode of governance with Local Self-Government in urban areas. The main provisions introduced by the Act were: Constitution of municipalities depending upon the size and area (Nagar Panchayat, Municipal Council, Municipal Corporation); Composition with both elected and nominated representatives. It also led to the constitution of Wards Committees with provision for adequate representation of SC/ST and of women in the municipal bodies. The municipality has a fixed term of 5 years.

**Atal Mission for Rejuvenation and Urban Transformation (AMRUT),** 2015 onwards led activities to upgrade conditions of basic services to households like water supply, sewerage, and urban transport. It has supported cities in designing open spaces, developing greenery, reducing pollution by increasing the usage of public transport, maintenance of stormwater drains, improving parking spaces, recreation centers etc.

**Pradhan Mantri Awas Yojana (PMAY) – Housing for all (Urban) 2015,** was designed to provide housing for economically weaker sections with a focus on women, ST, and SC. It operates in multiple modes with interventions like rehabilitation of slum dwellers, credit-linked subsidy, affordable housing through public or private partnership, and subsidy for beneficiary-led individual house construction or enhancement.

**Deen Dayal Antyodaya Yojana – National Urban Livelihood Mission (DAY-NULM), 2013** contributes to addressing the livelihood concerns of the urban poor. Under this, activities for improving social resilience like, helping the urban poor in self-employment by providing skill development and easy access to credit and providing shelter to the urban poor are undertaken. It provided support to informal sector workers, especially during uncertain times like COVID-19.

**Heritage City Development and Augmentation Yojana (HRIDAY), 2015** was launched to provide better amenities in Heritage cities. It has provisions for better infrastructure and services in Heritage cities like water, roads, and street lights, increase security with CCTV, toilets and preservation, conservation, and revitalization of Heritage cities.

**National Urban Transport Policy, 2014** highlights the deficit in urban transport services and infrastructure both in quality and quantity. It strives for equitable allocation of road space and safety on roads. The use of desirable modes of transport like walking, bicycling, and public transport needs to be promoted and the use of undesirable modes, i.e. cars and two-wheelers should be minimized.

**Swarnim Jayanti Mukhya Mantri Shaheri Vikas Yojana**, 2009 onwards was developed to strengthen and upgrade the infrastructure facilities in Gujarat at the city level. Under this, infrastructure projects related to water supply and underground drainage in the cities of the state are being taken up by the Gujarat Municipal Finance Board and the Gujarat Urban Development Mission. It is an umbrella programme that has projects like Nal Se Jal and Daily Water Supply for providing clean drinking water to all the families in the cities, Chief Minister Urban Bus Service Scheme (CMUBS) to support Urban Bus Services in Gujarat etc.

> ***Discuss with learners:*** *Request learners to discuss the SDG status of Gujarat and DRR policies that they are aware of. Have they adopted the National Building Code, Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines or similar guidelines in development projects in their jurisdiction. If yes, name some specific guidelines that you consider for hazard prone areas.*

**Session Plan**

| Content | Trainer's Note | Time |
|---------|----------------|------|
| Global frameworks | Focus on explaining the timeline of DRM frameworks, changes, priorities interlinkages to SDGs, with a focus on the urban context | 15 min |
| Policies in India | Detail out the DRM plans, policies and actions relating them to frameworks | 15 min |
| Policies in Gujarat | Detail out the DRM plans, policies and actions | 15 min |
| Discussion | A discussion on some of the key learning focusing on Gujarat's SDG status and DRR policies | 15 min |

## References

- India: Disaster Management Reference Handbook: August 2018 https://reliefweb.int/report/india/india-disaster-management-reference-handbook-august-2018
- Shifting The Paradigm: Introducing The Global Risk Assessment Framework (Graf) https://www.preventionweb.net/news/shifting-paradigm-introducing-global-risk-assessment-framework-graf
- Sendai Framework for Disaster Risk Reduction 2015 – 2030 https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf
- https://unhabitat.org/sites/default/files/2020/12/nua_handbook_14dec2020_2.pdf

# Notes

# Notes

# Learning Unit 1.3: Disaster Ethics and Humanitarian Actions

## Brief Description of the Learning Unit

The learning unit on disaster ethics and humanitarian actions engages with learners to identify the ethical dilemmas in the event of a disaster, the importance of ethics, the core principles, values and code of conduct for disaster risk management and humanitarian action and how to overcome associated ethical dilemmas.

## Learning Objectives

- To know about professional ethics and quandaries pertaining to disaster risk management and humanitarian actions
- To understand the code of conduct for disaster risk management
- To identify the core humanitarian standards and ethical duty of officials

**Duration:** 30 mins

## Methodology

- Lecture-based learning
- Scenario-based exercises

## Detailed Description

According to the United Nations Office for Disaster Risk Reduction (UNDRR), over the last 20 years, an average of 213 million people have been affected by disasters each year. In 2019 alone, natural hazard-induced disasters have caused an estimated $54 billion in damages and affected 89 million people globally. On account of their existing marginalization and vulnerability, certain individuals and communities disproportionately suffer the impacts of disasters. People living in high-risk areas, such as high seismic zones, or along the coast; low-income groups; those living in inadequate housing conditions; internally displaced persons; historically discriminated groups face violation of fundamental human rights that are exacerbated during and post disasters.

With increasing disasters globally, issues like rights to adequate housing, food, water, sanitation, livelihood, health and education are impacted. The impact of disasters on vulnerable populations impends growing humanitarian needs and reverses progress towards achieving SDG goals. The onus lies on states, and departments to undertake comprehensive and sustained efforts to safeguard the human rights of the affected population; and, to ensure that all disaster risk management activities are carried out in a way where a whole-of-society, gender-sensitive, and inclusive approach is undertaken. This highlights the importance of effective disaster response and the need to reflect ethical considerations in disaster risk management.

Ethics refers to actions by which moral outcomes can be achieved in specific situations. It is the study of codes of conduct and moral judgments concerning what is right and wrong (Jenson, 1997). Ethics can be considered the foundation on which societies and cultures are based and are important to decision-making. Ethics hold different from morals as they are societal standards, unlike morals that are rooted in individual belief systems. According to the American Heritage Dictionary, professional ethics can be considered as the rules or standards governing conduct, especially of the members of a profession.

*Fig1. Difference between Ethics and Morals*

Ethics as applied to disaster situations relies on universal truths of what is right and what is wrong, determination of how these can be applied to disaster situations and finally the morality of the individual making decisions during a disaster (Geale, 2012). Disaster ethics refers to the standards, principles and values that guide human behaviour and decision-making during disasters. It encompasses the obligations, responsibilities, and duties of individuals, organizations, and governments to respond to and prevent/ mitigate disaster risks, and to ensure the well-being and protection of affected populations. Ethical values motivating different agencies vary considerably depending on the nature and origin of the work that is undertaken by the agency for disaster risk management. E.g. The COVID-19 pandemic has raised numerous ethical issues related to the allocation of limited resources, the balance between individual rights and public health, and the responsibilities of healthcare workers.

**Ethical quandaries in disaster situation**
- How do we enforce limitations on individual rights? *Quarantine, evacuation, curfew*
- How to ethically allocate distribution of benefits?
- Should public participation be demanded from affected individuals during or post disaster?
- Determination of roles and duties. How to perform duty without compromising self-preservation?
- What duty is owed to public on disaster risk communication?
- What is the role of media and ethical journalism for disseminating messages during disasters?

*Add more examples from your experience. Ask learners to describe an experience regarding ethical decisions made by them which may have been different from departmental prerogatives.*

According to the Ethical Principles on Disaster Risk Reduction and People's Resilience by EUR-OPA, one of the fundamental principles of disaster ethics is the principle of **humanity**, which holds that all **human beings have a right to life, dignity, and security**. This principle requires individuals, organizations, and governments to prioritize the needs of vulnerable populations and to provide timely and effective assistance to those in distress. It also calls for the protection of vulnerable populations, such as women, children, the elderly, and persons with disabilities, from harm and exploitation.

It is complemented by the principle of **inclusivity** and **leaving no one behind.** One of the core aspirations of the 2030 Agenda for Sustainable Development has been inclusiveness and shared prosperity. It underscores the need to identify who is being left behind and in what ways. Some of the factors that have led to the exclusion of communities from development activities are poverty, access to livelihood opportunities, education, unequal platforms for participation, and lack of equity for marginalized sections of society. In instances of disaster planning the gaps in information availability, and non-inclusive design of infrastructures can be a significant challenge for persons with disabilities trand older persons. Practitioners in the urban context should take into consideration the findings of reports, research publications and initiatives undertaken for the vulnerable population; gather and integrate information from interaction with the communities into the plans and development projects. Post-disaster assistance should be given in an equitable manner to the
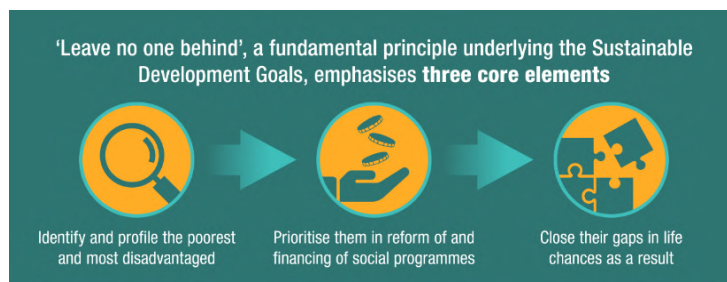
population affected.



*Fig 2. Leave No One Behind Principle (ODI)*

Another principle of disaster ethics is the principle of **impartiality** or non-discrimination, which requires officials to provide assistance to those in need, regardless of their race, religion, nationality, or political affiliation. This principle promotes equality and fairness in the provision of assistance and prevents discrimination or bias in the response. In the context of hazards in urban areas, development plans should be designed such that they should not prioritize the needs of real estate developers over low-income groups.

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**Scenario based exercise 1**
Unusual rains have led to flooding in many areas of high urban concentration where malaria has spread. Now, in the face of an exploding rate of hospitalization the municipal department plans to launch an awareness and management operation. Discuss:
- What strategy would you use to identify the settlement for first action?
- What type of participation would you expect from the community and media?

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The principle of **accountability** is also an important aspect of disaster ethics. This principle holds that individuals, organizations, and governments must be accountable for their actions and decisions in disaster risk management and must be transparent and open in their reporting and decision-making processes. It also requires them to be accountable to affected populations and to provide explanations and justification for their actions. For example, officials undertaking maintenance of built infrastructure should not refuse to share information or take action where it could become inconvenient for the common public. The information shared with media during, pre- or post-disaster should be true and from verified sources.

Disaster ethics also emphasizes the importance of **cooperation and coordination** in the disaster risk management effort. All departments must work together to effectively address the needs of vulnerable populations residing in hazard-prone areas and affected populations after the disaster, and must be willing to share resources and information to maximize the impact of the actions. For example the "**Good Samaritan Law**" in India passed in 2016 provides a legal framework to encourage bystanders, and first responders to assist accident victims without fear of negative repercussions. Although the law is still underdeveloped it considers the key points that hospitals should not refuse to treat accident victims and should not charge for First Aid, good Samaritans need not reveal identity, should be protected from civil and criminal liability, and can choose to be an eyewitness or otherwise. The officials working for urban development can consider working for the "**Right to city**" with the participation of local communities to further benefits and to participate in a town/ city's development.

Another key principle relevant to the urban context is "**Do no harm".** The "Do no harm" approach helps to identify unintended negative or positive impacts of humanitarian and development interventions in settings where there are impending risks. As the urbanization is increasing, informal settlements with poor basic facilities accumulate extensive risks that leads to a converging of urbanization and disaster risks. Actors responsible for developmental activities do not necessarily

adhere to the common principles and standards; by pursuing purposes deemed more important, like economic gains, political gains, increased shares, goodwill with a particular group etc. So, the "Do no harm" principle should be followed in all development projects and initiatives in the urban regions. Some more ethical considerations are listed in the figure 3.
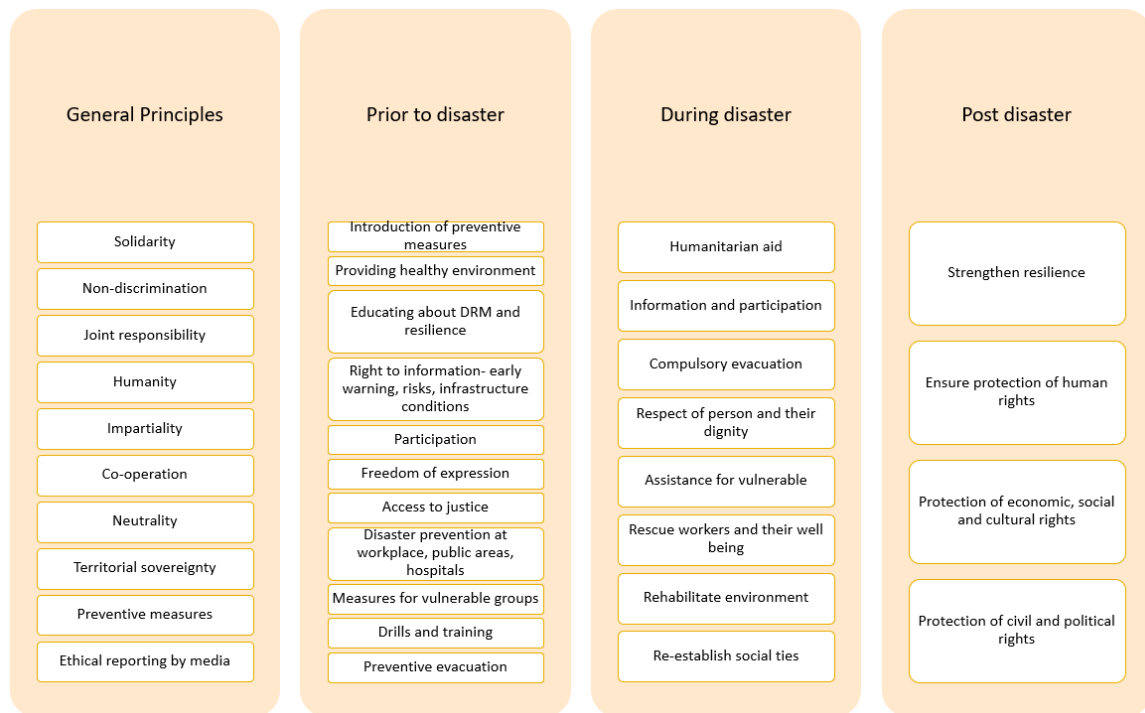


*Fig 3. Some Ethical Considerations for Disasters (adapted from EUR-OPA)*

**Scenario based exercise 2**

A catastrophic earthquake severely damaged the houses of over 100000 people of the state. Over 70000 had to evacuate to shelters identified by the disaster management authorities and were later relocated. Discuss:

- In the limited budget available which basic services would you choose to ensure for the displaced?
- What steps might be taken to improve response to the ensure protection in assisting displaced?
- What ethical principles would you choose to apply in such situation?
- Would you compensate the residents who have shared their public and private space for the displaced individuals? If yes, how?
- How would you coordinate with government, public sector agencies and private sector organizations so that the beneficiaries receive financial aid?

The International Law Commission makes no distinction between the types of disaster in its draft articles on the protection of persons in the event of disasters. It identifies that **human rights should not be ignored under the pretext of exceptional circumstances**. The ethical principles mostly concern individuals, but may also apply to government bodies, although ethical concerns have a more natural link with personal law than institutional law. The Code of Ethics of the International Association of Emergency Managers (IAEM) states support for the following Core Values: **Commitment, Professionalism, Respect**

In India, currently, there is no specific government-approved Code of Ethics for emergency management.

| | | |
|---|---|---|
| Humanitarian imperative comes first | Financial assistance should not be used to further a particular political or religious standpoint | Aid should be given without discrimination to the recipients and without adverse distinction of any kind. Priorities are calculated on the basis of need alone |
| One should respect local customs and cultures of the community | One shall attempt to build disaster response on local capacities | Ways shall be found to involve programme beneficiaries in DRM |
| Actions undertaken should reduce future vulnerabilities to disaster as well as meeting basic needs | Remain accountable to both beneficiaries and those who provide resources | Ensure that all communication, publicity etc. from the department should recognize disaster victims as dignified humans |

*Fig 4. Code of Conduct for Disaster Risk Management (Adapted from ICRC)*

There are laws in India that protect the people at higher risk from the impacts of disaster events in India. The **Disaster Management Act, 2005** has a unique feature where it mentions dealing with the provisions concerning the protection of human rights by providing specific guidelines with reference to minimum standards of relief to be provided to persons affected by the disaster as recommended by the National Disaster Management Authority, which shall include the minimum requirements in relation to shelter, drinking water, medical and sanitation. Under the 'social security and social insurance, employment and unemployment clause of the act it ensures a holistic and agile disaster management instrument while covering all phases of prevention, mitigation, preparedness reconstruction and recovery. Under the Hazardous Waste (Management and Handling) Rules, 1989 industries are bound to take steps and ensure that hazardous waste disposal is managed in a manner that ensures protection of the local population and the immediate environment from any adverse effects. Public Liability Insurance Act, 1991 (PLI 1991) provides prompt and immediate relief to victims of accidents incurred while handling hazardous substances.

> **Scenario based exercise 3**
> You are in charge of evacuation operations in a flood hit metro city. Severe floods have devastated the city. Many homes have been submerged. The areas where upper middle class and rich people are less severely affected, but the areas where poor live have been completely devastated. They are in urgent need of evacuation. Floods have washed many people in poor colonies away and majority of them require urgent intervention. Important government functionaries, businessmen and influential people have been stuck in their homes and have used their connections to seek immediate help. You are asked by concerned cabinet minister to first evacuate these people and reach them to safe places. Minister tells you that many of his relatives live in those areas. But, the situation warrants that the poor must be evacuated first.
> - What will you do in this situation? Justify and give examples of such dilemmas a public servant might face while serving her country and the measures you would take to overcome those situations.

With the core belief in life with dignity and alleviation of human suffering due to disaster, **Sphere Minimum Standards** identified four key sectors:
- Water Supply, Sanitation and Hygiene Promotion (WASH)
- Food Security and Nutrition
- Shelter and Settlement
- Health

While working in the urban context municipality and municipal corporations will often be the key

government authority, with links to other government departments and line ministries that support disaster risk management. They hold the potential to assess the needs of basic services, food security and livelihoods, including any discrimination. The Sphere Minimum Standards can support the identification of entry points for developing programmes to assist in urban areas, including through housing, and finances, with area-based approaches. Working with local actors (such as the private sector, leaders, youth and community groups) can be vital in supporting and strengthening basic services. It may be useful to identify international, bilateral support in municipal investment planning that can create value in the longer term.

The **Minimum Standards of Relief** guidelines were set by the National Disaster Management Authority as mandated by the Disaster Management Act (Section 12). It was adopted by the Government of Gujarat and includes the minimum requirements to be met in the relief camps in terms of housing, food, drinking water, medical care and sanitation, and special provisions for widows and orphans. Voluntary assistance in the event of loss of life and assistance for damage to houses and to restore livelihoods and any other essential facilities.

Based on these minimum standards, the **Gujarat State Disaster Management Plan** highlights that:
- Households in disaster-affected areas must be given the supplies, tools, and equipment they need to safely repair, rebuild, and maintain their shelter
- Open areas or community facilities should be located where relief camps can be put up during emergencies with easy accessibility
- 3.5 sq m of covered area per person with basic lighting facilities in the shelter should be provided to accommodate the affected
- Inclusion of facilities for drinking water (3 litres per person per day), food (2400 Kcal/day for adults and 1700 Kcal/day for children), bathing, sanitation, and basic medical treatment in the relief camps

Some of the identified immediate response standards by the state government are:
- A special emphasis should be placed on sanitation and hygiene issues in camp locations
- A specific space should be set out for the storage of supplies in camp locations
- Enough personnel and transportation resources should be allocated for the camp location.
- Plans for trauma management should be established for the affected.
- Mobile medical units will be dispatched to isolated places to provide victims and injured people with medical care.
- The administration should build an information center.

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**Scenario based exercise 4**

There is a disaster-prone state having frequent landslides, forest fires, cloudbursts, flash floods and earthquakes, etc. Some of these are seasonal and often unpredictable. The magnitude of the disaster is always unanticipated. During one of the seasons a cloudburst caused a devastating floods and landslides leading to high casualties. There was major damage to infrastructure like roads, bridges and power generating units. This led to more than 100000 pilgrims, tourist and other locals trapped across different routes and locations. The people trapped in your area of responsibility includes senior citizens, patients in hospitals, women and children, hiker, tourist, ruling parties, regional presidents along with his family, additional chief secretary of the neighboring state and prisoners in jail.
- As a civil services officer of the state, what would be the order in which you would rescue these people and why?

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In conclusion, disaster ethics provides a framework for ethical behaviour during disasters and guides individuals, organizations, and governments in their decision-making and response efforts. By

prioritizing the needs of affected populations and ensuring fairness, accountability, and cooperation, disaster ethics helps to promote the well-being and protection of those affected by disasters.

**Session Plan**

| Content | Trainer's Note | Time |
|---|---|---|
| Ethics and dilemma | Focus on explaining the professional ethics, ethics vs morals core values, quandaries | 5 min |
| Ethical principles | Detail out the principles at all stages of disaster with elaborate examples. | 15 min |
| Discussion | A discussion on situations faced by the participants in real life related to disaster ethics | 10 min |

**References**

- Sphere Standards Handbook https://spherestandards.org/wp-content/uploads/Sphere-Handbook-2018-EN.pdf
- Universal Declaration of Human Rights https://www.un.org/en/universal-declaration-human-rights/
- Minimum Standards of Relief https://nidm.gov.in/PDF/pubs/NDMA/19.pdf
- Ethical Principles on Disaster Risk Reduction and People's Resilience https://www.preventionweb.net/publication/ethical-principles-disaster-risk-reduction-and-peoples-resilience
- Code of Conduct for the International Red Cross and Red Crescent Movement and NGOs in Disaster Relief https://www.ifrc.org/document/code-conduct-international-red-cross-and-red-crescent-movement-and-ngos-disaster-relief
- Geale, Sara. (2012). The ethics of disaster management. Disaster Prevention and Management. 21. 445-462. 10.1108/09653561211256152.

**Additional Reading**

- Protecting Human Rights in Disaster Response Guidelines for State and Non-state Actors https://www.hlrn.org.in/documents/Protecting_Human_Rights_in_Disaster_Response_HLRN.pdf

# Notes

**Notes**

## Summary

The Technical Session 1 guides the learners on:

- Key concepts, terminologies and global frameworks relevant to disaster risk management and climate change adaptations
- Frameworks that establish the risk management interventions into urban policy, disaster and engineering context
- Existing plans and polices in India and Gujarat that guide interventions for minimizing disaster risks, stresses and challenges
- Ethical dilemmas in risk reduction and principles to guide interventions ethically

# Technical Session 2: Introduction to Urban Systems, Their Interdependencies and Their Risks

## Introduction, Overview & Perspectives

This technical session aims to provide learners with an understanding of the complex risks and interdependencies associated with urban systems in the context of Gujarat, a rapidly urbanizing region in South Asia. Through a combination of theory and discussion, the session will introduce learners to the key risk factors and vulnerabilities of urban areas in Gujarat and examine the interrelated systems that influence the risk and resilience of these areas. In Learning Unit 2.1, learners will examine the risk profile of Gujarat in the urban context, including an analysis of the key hazards, exposure, vulnerabilities, and impact of climate change. In Learning Unit 2.2, learners will analyze the interdependencies of urban systems, including transportation, water, energy, and communication, and their role in shaping the resilience of urban areas. Learners will explore the relationships between these systems, associated vulnerabilities, and risks. In Learning Unit 2.3, learners will apply systems thinking to analyze the potential impact of associated risk through a case study or group exercise that integrates the concepts learned in the previous two units.

Overall, this technical session will equip students with the knowledge needed to understand the complex risks associated with urban areas in Gujarat.

The learning units of this session are as follows:
- Learning Unit 2.1: Risk Profile of Gujarat in the urban context
- Learning Unit 2.2: Urban Systems and associated risks
- Learning Unit 2.3: Case Study/Group Exercise - Interdependencies of urban systems

The primary objectives of this technical session are:
- To develop an understanding of the risk profile of urban areas in Gujarat, including the identification of key hazards, exposure and vulnerabilities
- To analyze the complex interdependencies of urban systems, including transportation, water, energy, and communication
- To apply systems thinking and interdisciplinary approaches to assess the potential effects of various risks

**Duration**: 180 minutes

## Methodology
- Lecture-based learning
- Discussion

- Group activity
- Q&A session

**Trainers' Note**

While introducing the learners to the risk profile of the state, trainers can plan short participatory exercises seeking learners to list out these risks first following which they can be taken through the detailed risk profile of the state. This will also help understand how well the learners have grasped the terminologies and concepts discussed under Technical Session 1.

Further, in this technical session, the trainers should delve into different urban systems, in general, and those prevailing in Gujarat, in particular. Efforts should be made to underscore the inter-dependencies among these systems, identify associated risks and establish how the effects on one have the potential to trigger effects on other inter-connected systems. Trainers can leverage the diverse background and experiences of the learners in generating discussion on different urban systems the learners are associated with and their experience of inter-dependencies among these, associated risks and management of the same.

# Learning Unit 2.1: Risk Profile of Gujarat in the Urban Context

**Brief Description of the Unit**

The goal of the learning unit is to provide a comprehensive understanding of the risk profile of Gujarat in the urban context. It provides a comprehensive understanding of various risks faced by cities and towns in the state of Gujarat. It covers the major hazards the state and especially the ones its urban areas are prone to along with the key vulnerability conditions. The learning unit is designed to provide a thorough analysis of the risks and their causes, as well as the impact on the urban population, infrastructure and assets.

**Learning Objectives**
- To study the major hazard profile of the urban areas of Gujarat
- To understand the key vulnerability conditions in the urban areas of Gujarat

**Duration:** 60 minutes

**Methodology**
- Lecture-based learning
- PowerPoint Presentation
- Q&A session

**Detailed Description**

**Urban Profile of Gujarat:**

Gujarat is a state located in the western part of India. It has a population of over 60 million people (Census of India, 2011) making it one of the most populous states in the country. The decadal growth rate of urbanization for the state is 19 percent (ibid.). Gujarat is divided into 33 districts, and several important towns and cities. The capital city of Gujarat is Gandhinagar. Some of the major cities in the state include Ahmedabad, Surat, Vadodara, Rajkot, and Jamnagar. These cities are important economic centers, with strong business and industrial sectors. The urban population in Gujarat accounts for approximately 42% of the total population (Census of India, 2011), and the state has several cities with a population of over one million, including Ahmedabad, Surat, Vadodara, and Rajkot. Ahmedabad, the largest city in Gujarat, has a population of over 7 million and is considered one of the most important economic centers in Western India. The state has a strong tradition of entrepreneurship and business and is home to several major industries, including textiles, chemicals, and petroleum. Table 1 is the list of the metro cities of Gujarat (1 million plus cities).

While the state has been a major powerhouse, its urban centers are prone to varied hazards including earthquakes, floods, cyclones, droughts, and heatwaves. The urban areas of Gujarat are particularly at risk due to factors such as rapid urbanization, poor developmental practices, poor data availability on disaster risk and poor infrastructural quality (NIDM, 2021). The risk profile of Gujarat in an urban context is complex, which poses a threat to the safety and well-being of not only its residents but also to the infrastructure, urban systems and associated assets

Table 1: Cities with 1 million plus population (Census of India, 2011)

| City | Area (sq.km) | Population | Population density in sq.km |
|------|-------------|------------|----------------------------|
| Ahmedabad | 505 | 6357693 | 12589 |
| Surat | 474 | 4645384 | 9797 |

| Vadodara | 454 | 3041791 | 6695 |
| Rajkot | 160 | 1390640 | 8692 |


*Fig 1. Locational Map of Gujarat (MapsofIndia, 2023)*

## Risk Profile of Gujarat Urban Zones

Gujarat is prone to a number of hazards, including earthquakes, cyclones, and floods. The state is located in an earthquake-prone zone (BMTPC, 2019) and has experienced several moderate to strong earthquakes in the past. The state is situated within the "Himalayan Collision Zone," where the Indo-Australian tectonic plate moves beneath the Eurasian plate, creating active fault lines below (GSDMA, 2023). Gujarat is also affected by severe cyclones that form in the Arabian Sea. Additionally, the state experiences frequent floods due to heavy rainfall during the monsoon season. As per the Gujarat State Disaster Management Authority (GSDMA), the following are the major hazards in Gujarat's urban centers:

## Geo Hazards

**Earthquakes:** Gujarat is located in a seismically active zone and is vulnerable to earthquakes (BMTPC, 2019). The urban areas of Gujarat including Ahmedabad, Surat, Gandhinagar, Bhavnagar, Vadodara, and Rajkot are located in moderately damage risk seismic zone III. Cities such as Morbi are in high-damage risk zone IV, and Gandhidham, Mandvi are in Seismic zone V with very high-risk damage (BMTPC 2019; GSDMA, 2021). The state has a history of devastating earthquakes, including the 2001 Bhuj earthquake that resulted in 13805 fatalities (Mishra, 2004). Major cities in the state, such as Ahmedabad and Bhuj, are at high risk of damage from earthquakes due to factors such as inadequate building codes, poor construction practices, and the presence of older, vulnerable buildings. In urban areas, the impact of earthquakes can be amplified due to factors such as high population densities, inadequate infrastructure, and the presence of critical facilities such as hospitals and schools.
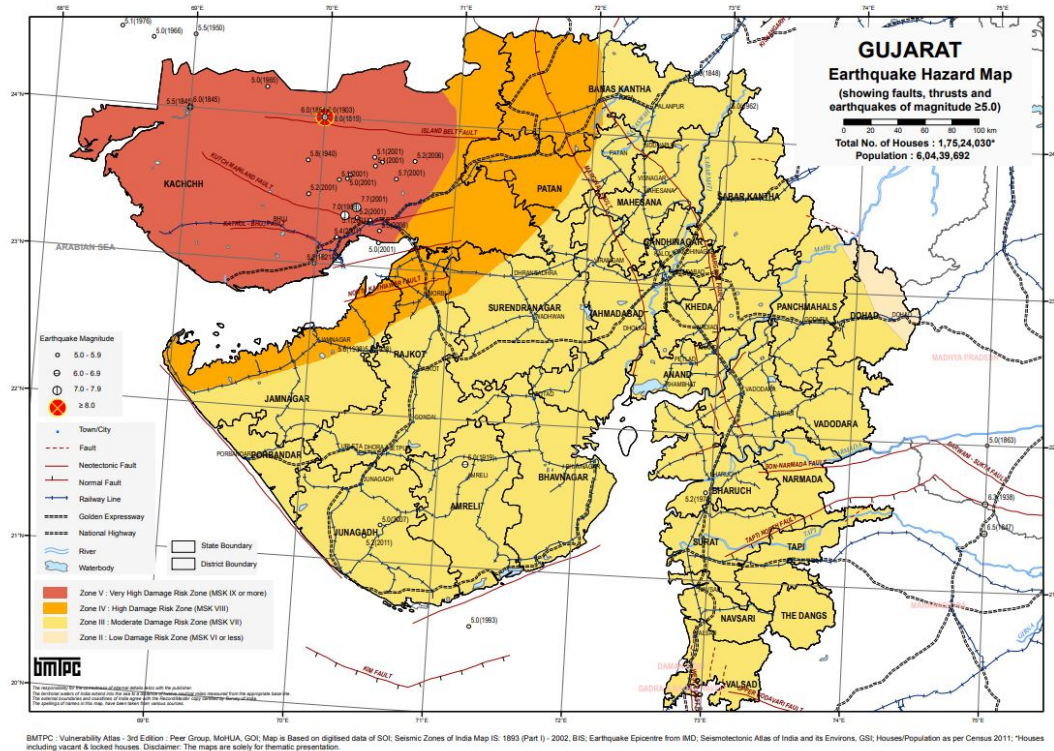
*Fig 2. Earthquake Hazard Risk Map of Gujarat (BMTPC, 2019)*

## Meteorological and Hydrological Hazards

**Floods:** Urban areas in Gujarat are vulnerable to the risk of floods, and are classified under moderate flooding zones, as per BIS (BMTPC, 2019). The Flood Hazard Map indicates that the areas most susceptible to flooding are primarily located along major rivers in the state (ibid.). The surrounding areas of these rivers experience flooding due to overflowing river banks and poor drainage in certain areas, as well as river bank erosion. The basins of the Narmada, Sabarmati, Mahi and Saurashtra rivers frequently experience riverine floods due to heavy rainfall upstream.

Additionally, the urban areas of the state face flooding due to high intensity rainfall and cloudburst, which gets aggravated due to several factors in urban areas such as rapid urbanization, unplanned development, lack of disaster risk preparedness, inadequate infrastructure and so on (Parkash et al., 2021). This is called **urban flooding** (EPW, 2022). Urban flooding is a major issue in the urban areas of Gujarat, particularly during the monsoon season (Parkash et al., 2021). The problem of urban flooding is exacerbated by the fact that many urban areas in Gujarat are located on the coast and are prone to tidal surges, which can result in heavy flooding during high tides. In addition, many areas have undergone infrastructural development, leading to an increase in the number of impervious surfaces such as buildings, roads, and parking lots, which can result in increased runoff and exacerbate the problem of flooding (ibid.). Urban flooding can have a number of negative impacts, including damage to infrastructure and homes, loss of property and belongings, and increased health risks due to the spread of waterborne diseases. It can also result in traffic disruptions, loss of business, and a decrease in the quality of life for those affected.

Some of the key urban areas in the state that are at high risk of floods include Surat, Ahmedabad, and Vadodara. The major flood events reported in the urban centers include Surat Floods (2006) whereby, heavy rainfall caused the Tapi River to overflow, leading to widespread flooding in Surat City (Mavalankar & Srivastava, 2008). The floods resulted in significant damage to infrastructure, including homes and businesses, and caused several fatalities. Another major incident was the Vadodara Floods of 2019, where heavy rainfall caused widespread flooding in Vadodara city,

resulting in inundation of the region, alongside the inflow of wild crocodiles from nearby Vishwamitri river posing challenges to the community and other stakeholders.



*Fig 3. Transport Infrastructure Impacted by the Vadodara Floods of 2019 (Skymet Weather, 2019)*

In India, especially in urban centers such as Ahmedabad, floods are a recurrent phenomenon and cause widespread damage to infrastructure, and communities. The IPCC has highlighted that the increased frequency and severity of floods in India are due to a combination of factors such as changing rainfall patterns, rising temperatures, melting glaciers, and sea-level rise. (IPCC, 2022)
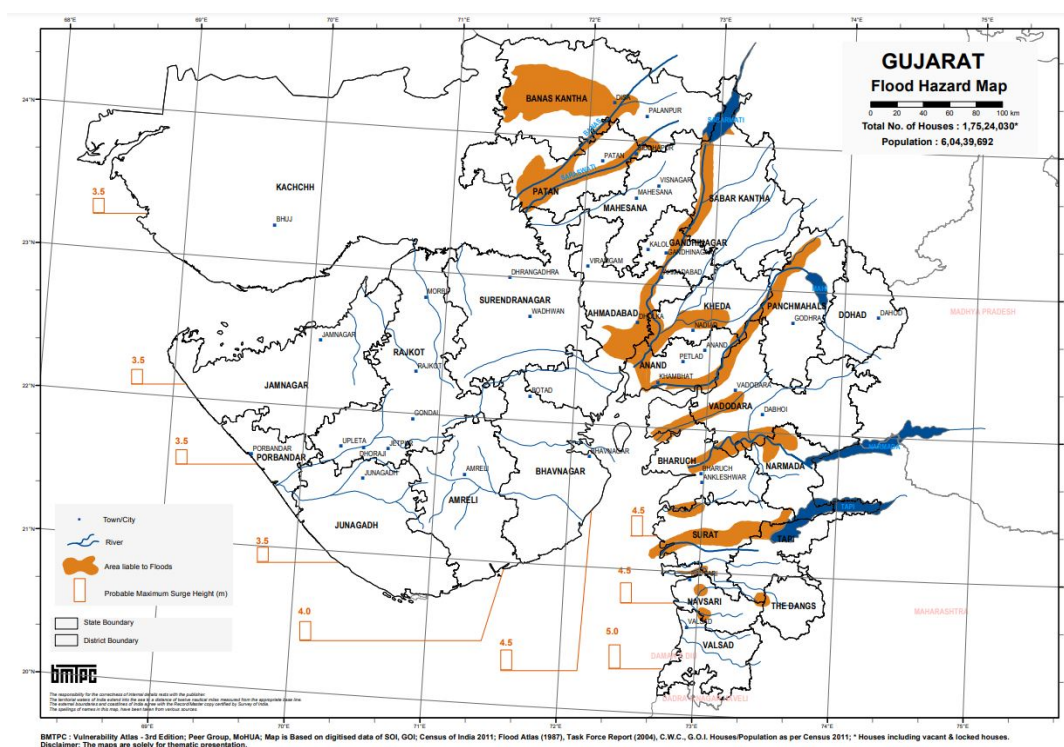


*Fig 4. Flood Hazard Risk Map of Gujarat (BMTPC, 2019)*

**Cyclones:** Urban areas in Gujarat are also vulnerable to cyclones and associated hazards, which can cause significant loss to lives and damage to infrastructure, homes, and businesses. Some of the major urban areas in the state that are at risk of cyclones include Ahmedabad, Surat, and Vadodara (BMTPC, 2019). Reasons for the cyclone hazard risk in urban areas in Gujarat include the geographic location of the state, unplanned urbanization, lack of preparedness, and so on. Some major cyclones that have affected urban areas in Gujarat in recent years include Cyclone Vayu in

2019 and Cyclone Tauktae in 2021, whereby the cyclone made landfall near the city of Surat, causing widespread damage to homes and businesses in the region.
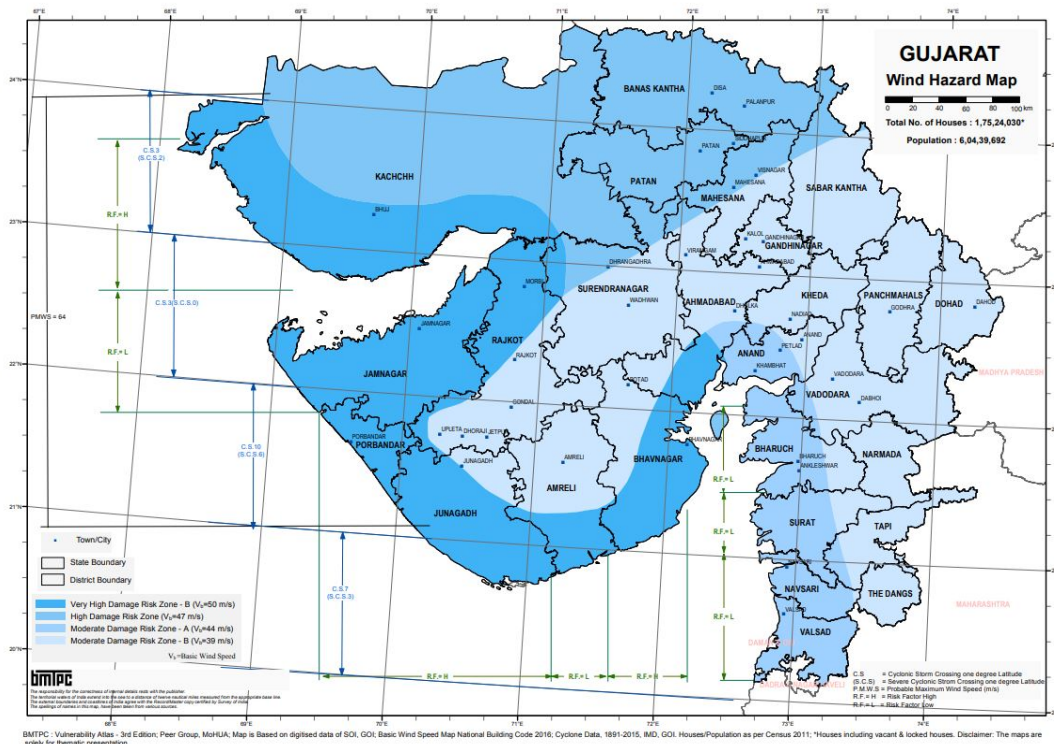


*Fig 5. Wind hazard map of Gujarat (BMTPC, 2019)*

The IPCC Sixth Assessment Report concludes that there is high confidence that the frequency and intensity of tropical cyclones have increased in some regions; including in the Arabian Sea and that there is medium confidence that human influence has contributed to these changes. The report also notes that global warming will probably lead to further increases in the frequency and intensity of tropical cyclones, which could cause more frequent and severe effects, including storm surges, flooding, and wind damage. (IPCC, 2022)

***Discuss with learners:*** *How has the risk landscape changed in the state, city and jurisdiction? List some emerging risks in recent years.*

**Droughts:** Urban areas in Gujarat are also vulnerable to the risk of meteorological droughts (due to precipitation shift) and socio-economic droughts (due to social issues such as over-extraction for industries), which can have significant impacts on communities, including water scarcity, and reduced economic activity. Some of the key urban areas in the state that are at high risk of droughts include Ahmedabad, Surat, and Rajkot (Langa, 2021). The reasons for droughts in urban areas in Gujarat include the over-extraction of groundwater, changes in precipitation patterns, and increasing temperatures due to climate change, inefficient water management. Some major droughts that have affected urban areas in Gujarat in recent years include Drought in 2018, whereby a severe drought, due to a combination of monsoon failure in the second half of 2018, sustained heatwaves and so on, affected the regions of Gujarat, including major cities such as Patan, Ahmedabad and so on (JRC Global Drought Observatory, 2019). These impact the urban management, quality of life etc., and could result in ghost towns. A critical urban planning analysis by the Rajkot Urban Development Authority in 2015, has suggested that they are able to supply only 20 minutes of water daily as against the benchmark of 24 hours, by the URDPFI. The region is highly challenged by the meteorological drought, with the report suggesting that there has been below the normal rainfall for the last twenty years (RUDA, 2015).
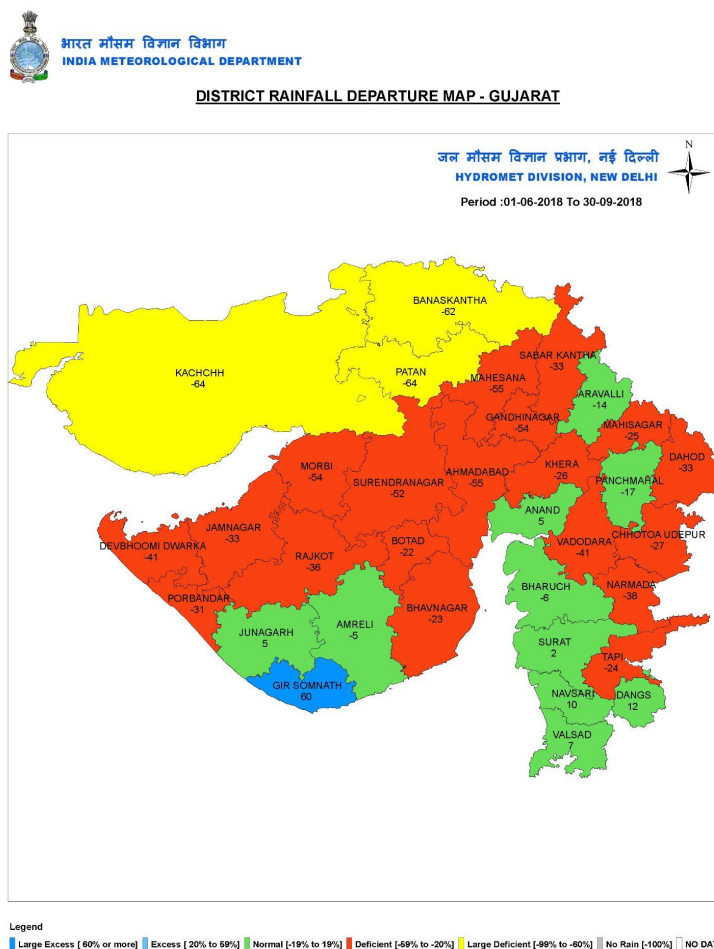
*Fig 6. Rainfall Deficit Map of Gujarat, 2018 Resulting in 2019 Drought (IMD, 2019)*

**Heat waves**: Urban areas in Gujarat are at risk of heat waves, which can have severe impacts on human health and well-being, as well as on working conditions and local economies (GSDMA, 2020). Some of the major urban areas in the state that are vulnerable to heat waves include Ahmedabad, Surat, and Vadodara. Reasons for heatwaves in urban areas in Gujarat include the Urban Heat Island Effect (whereby the concentration of concrete and other heat-absorbing materials in urban areas can result in higher temperatures compared to rural areas, leading to heat wave conditions), climate change, poor air quality, and so on (ibid.).

Some major heat waves that have affected urban areas in Gujarat in recent years include the Ahmedabad Heatwave in 2010 whereby a heatwave affected the city of Ahmedabad, causing 1,344 heat-related fatalities among the city's population. Similar incidents were reported in In April 2022, several cities in Gujarat experienced heatwave conditions with temperatures reaching above 40°C, causing widespread concern among the residents.

A **Heat Wave** is a period of unusually high temperatures, exceeding the normal maximum temperature, which typically occurs in the North-Western parts of India, including Gujarat between March and June, and occasionally extends until July.

The Indian Meteorological Department (IMD) has established criteria for defining Heat Waves, which state that the authorities need not consider heat waves until the maximum temperature of a station reaches **at least 40°C for Plains and at least 30°C for Hilly regions**.

For stations with a normal maximum temperature less than or equal to 40°C, Heat Wave **Departure from normal is 5°C to 6°C, and Severe Heat Wave Departure from normal is 7°C or more**.

For stations with a normal maximum temperature of more than 40°C, Heat Wave **Departure from normal is 4°C to 5°C, and Severe Heat Wave Departure from normal is 6°C or more**.

Additionally, Heat waves should be declared when the actual **maximum temperature remains 45°C** or more, irrespective of the normal maximum temperature. (NDMA, 2023)
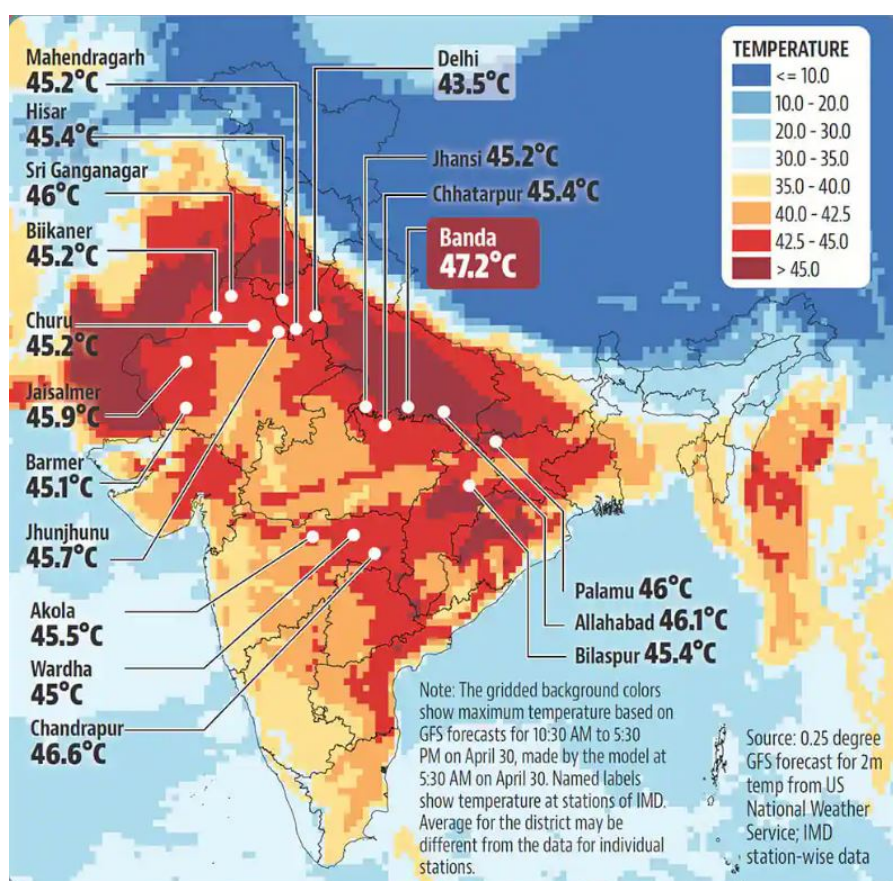


*Fig 7. Temperature Map of India during 2022 (IMD, 2022)*

According to the Intergovernmental Panel on Climate Change (IPCC), due to climate change, heatwaves are becoming more frequent, and intense, and starting earlier in many parts of the world, including South Asia. The IPCC's Sixth Assessment Report states that heatwaves and humid heat stress will become more intense and frequent in the region this century, posing a significant threat to human health and well-being. (IPCC,2022)

**Fire hazard:** There are numerous reasons why fires occur in Gujarat, including mishandling flammable materials and chemicals, electrical short circuits, negligence, gas leaks, and accidents. Gujarat is a highly industrialized state, hence fire incidents are also more likely. Every year, fire results in significant losses of life and property. Unplanned urban development and disregard of statutory permission also lead to losses after a fire. Some notable incidents of fire are Surat commercial complex fire in 2019, the denim factory fire in Narol in 2020, the hospital fire in Bharuch in 2021, Kheda plastic factory fire in 2023. Currently, a robust central database that details the distribution of fire service infrastructure, the stock of existing fire fighting vehicles, personnel, and specialized equipment, as well as the types and amounts of each is not available in Gujarat.

**Chemical hazards**

**Industrial and Chemical Hazards**: Industrial and chemical hazards in urban areas of Gujarat can have serious consequences for the health and well-being of local communities and the environment. Some of the reasons for the industrial hazards involve inadequate regulation and enforcement of safety and environmental standards in industrial facilities and chemical storage sites, poor waste management practices, leading to the release of hazardous chemicals and pollutants into the air, and so on. These can cascade into other hazards such as air pollution, and water pollution. Some notable incidents of industrial and chemical disasters in Gujarat include the 2022 chemical leak in Surat, which resulted in 6 deaths and left 23 sick among residents. A large portion of the country's Major Accident Hazard (MAH) units are located in the state, with concentrations in areas such as Vapi, Hazira, Ankleshwar, and Dahej. There are a total of 633 MAH-prone industrial units in Gujarat, which highlights the need for enhanced safety measures and regulations to minimize the risks posed by these hazardous industrial activities (GSDMA, 2021). The following are some of the major industrial and chemical risk maps in Gujarat.
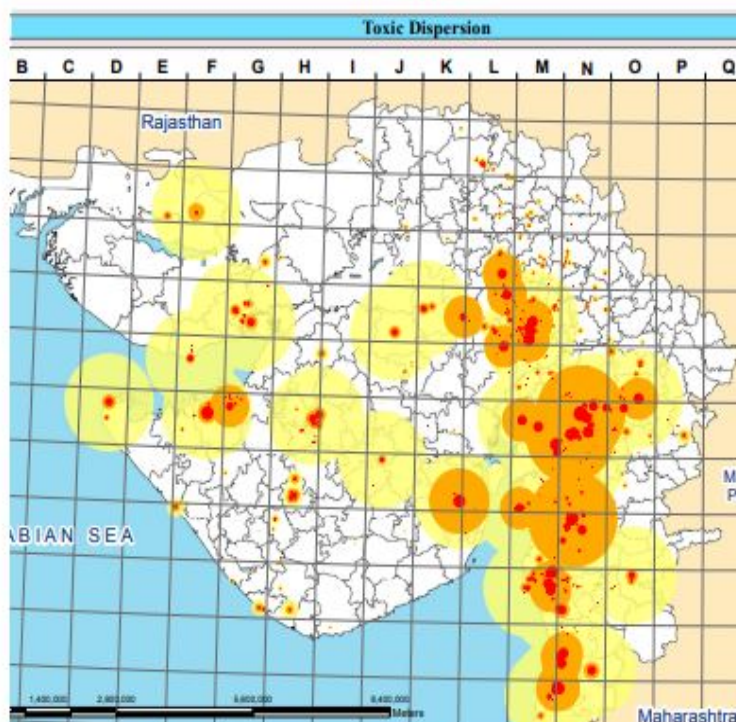


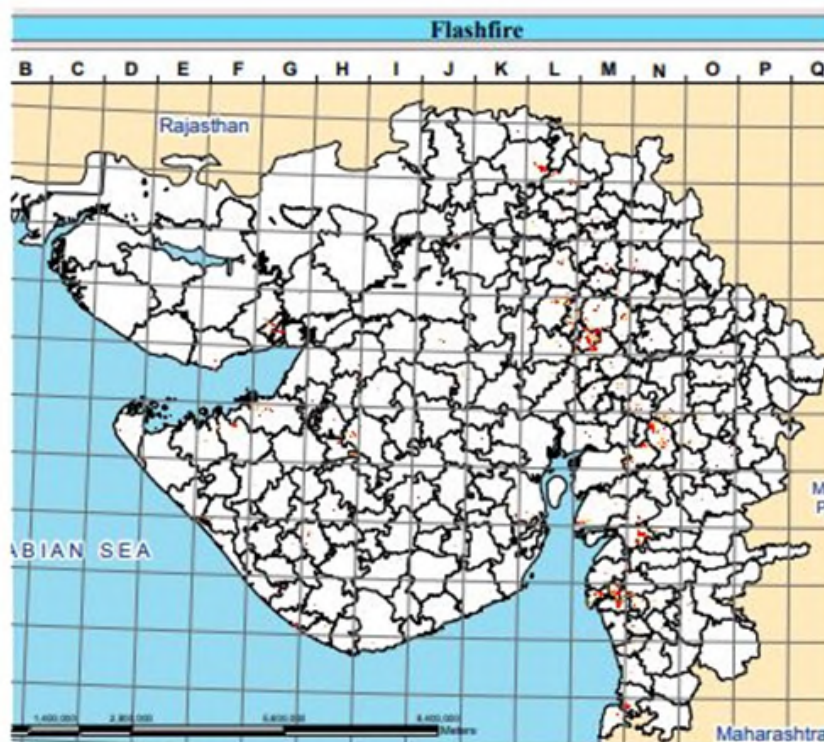*Fig 8. Vulnerable Areas for Toxic Dispersion, Gujarat (GSDMA, 2013)*

*Fig 9. Vulnerable Areas for Flash Fire, Gujarat (GSDMA, 2013)*

**Biological Hazards**

**Epidemics Outbreak:** Urban areas in Gujarat, like many other densely populated cities, are susceptible to the spread of infectious diseases, also known as epidemics. Epidemics are caused by the spread of infectious agents, such as viruses, bacteria, fungi, and parasites. The agents are typically transmitted from person to person, through direct contact with infected individuals, through contact with contaminated objects, through droplets from infected individuals, or through airborne transmission. Various factors, including poor sanitation, lack of access to clean water, overcrowding and weak healthcare systems results in their rapid spread. Some examples of epidemics that have occurred in urban areas of Gujarat include:

- **Dengue**: Dengue is a viral disease spread by mosquitoes. Urban areas of Gujarat are at risk of dengue outbreaks, particularly during the monsoon season when mosquito populations are high. (Magotra & Shaw, 2020) reports that Rajkot, one of the fastest growing cities in Gujarat, and has recorded increasing dengue incidences from 327 cases (2010) to 763 in 2018, and suggests urbanization, and overcrowding as a key drivers to it. The report further assesses the correlation of the dengue spread with the slum and suggests that slum areas are to be prioritized for more resource allocation for the efficient prevention and control of dengue (ibid.). These include efficient drainage and solid waste management such as closed drainage design, and so on.

- **Cholera**: Cholera is an acute diarrhoea disease that is spread through contaminated water and food. Outbreaks of cholera have been reported in urban areas of Gujarat, particularly in slum communities with limited access to clean water and sanitation. The statistical analysis of housing reports in India suggests that around 17 percent of the urban community uses untreated tap water for their daily sustenance in Gujarat(MoHUPA, 2013).

- **Malaria**: Malaria is a parasitic disease spread by infected mosquitoes. Urban areas of Gujarat, particularly those with poor sanitation and lack of mosquito control measures, are at risk of malaria outbreaks. Gujarat reported over 4785 cases of Malaria in 2022 (MoHFW, 2023).

- **Swine Flu**: Swine flu is caused by the H1N1 virus, which originally came from pigs but can also be transmitted from person to person. Urban zones of Gujarat have reported cases of swine flu. For example in 2023, 74 cases of swine flu were reported in Gujarat till February 2023 (PIB, 2023)

- **Bird flu,** also known as avian influenza, is caused by a type of influenza virus that primarily affects birds, but can also infect humans and other animals. It is usually spread by contact with infected birds, either through direct contact or through their droppings or secretions.

The COVID-19 pandemic of 2020 has had a significant impact on urban areas in the state of Gujarat and has generated cascading impacts on the community, and other stakeholders. Urban areas, being densely populated and having large numbers of essential workers, have seen high levels of transmission of the virus. This has led to increased stress on healthcare systems and hospitals, as well as disruptions to the local economy, including job losses, reduced consumer spending, and business closures. In addition, the lockdowns and other physical distancing measures put in place to slow the spread of the virus have resulted in widespread economic hardship, particularly among low-income and vulnerable populations in urban areas. Schools, colleges, and other educational institutions have been closed, causing disruptions to students' education and adding to the stress on families. Urban areas have also seen a rise in mental health issues due to the stress, uncertainty, and fear brought about by the pandemic. The closure of social and recreational spaces, as well as the limitations on social interactions, has also had a negative impact on people's overall well-being.
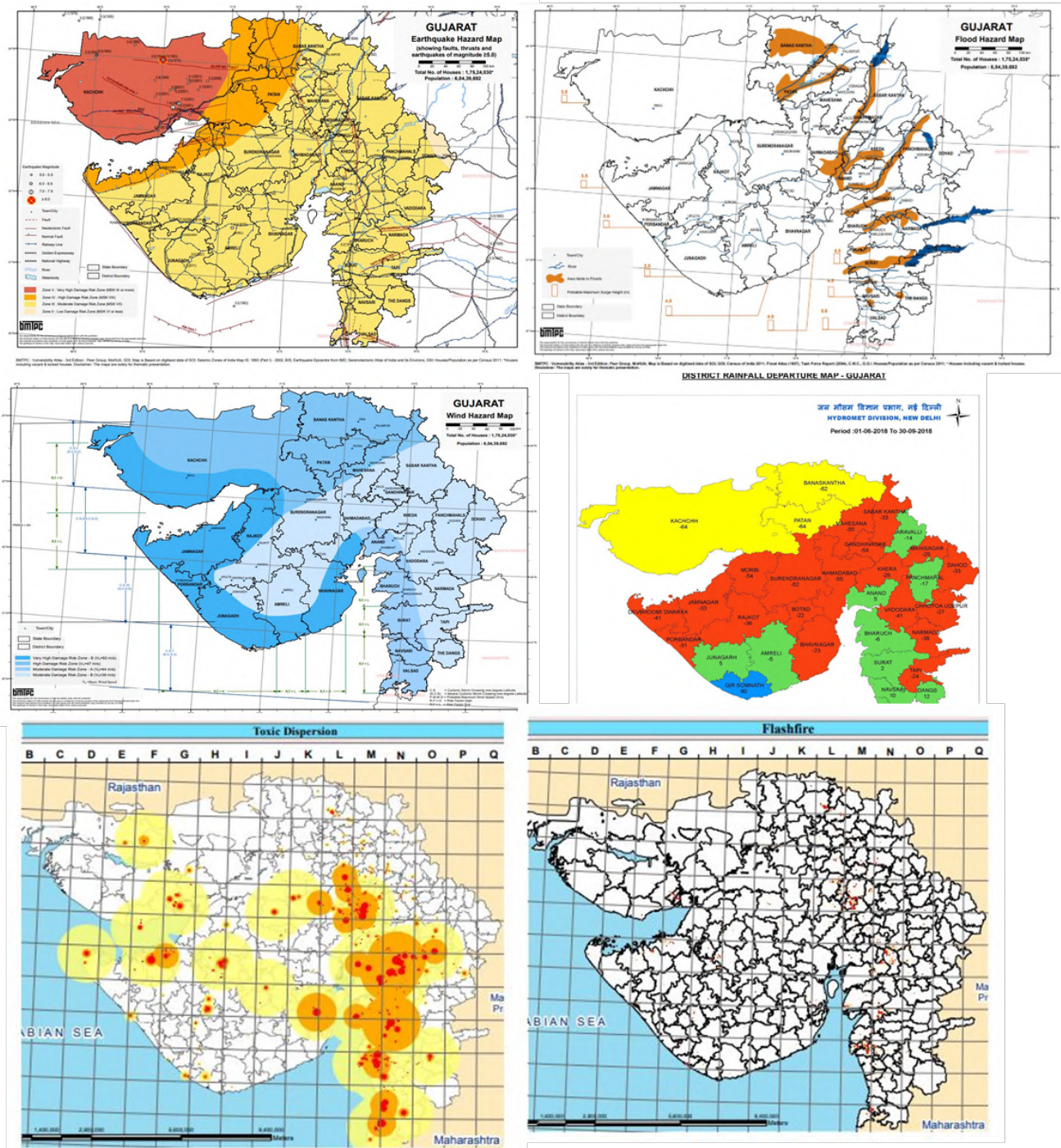
*Fig 10. Hazards Maps of Gujarat*

## Key vulnerabilities conditions in Gujarat

The key exposure and vulnerabilities conditions in Gujarat include

- **Physical Vulnerability**: Physical vulnerability of the systems is a key issue in Gujarat urban zones. As discussed, the physical vulnerability of urban areas in Gujarat is a major concern and arises from various aspects, including the state's position on the western coast of India and its exposure to various natural hazards, such as earthquakes, floods, droughts, and cyclones, as a result of these positions. For e.g. the coastal towns of Gujarat are highly susceptible to cyclones, which can trigger secondary events such as tidal surge. One of the main issues that influence the vulnerability is the unplanned urbanization in urban areas of Gujarat (Khanuja. J, 2014), which

exacerbates the impacts of disasters. This is significant as it can result in consequences that can exacerbate other hazards.

- **Structural Vulnerability** refers to the potential for physical infrastructure systems to be damaged, disrupted, or destroyed by natural or human-induced hazards. This can include critical infrastructure such as transportation systems, power grids, water and sewage systems, telecommunications networks, and buildings. In Gujarat, some of the key infrastructural vulnerabilities may include poor construction practices, inadequate maintenance of infrastructure systems, and a lack of planning and preparedness for disaster events (Parkash et al., 2021). This can lead to significant disruptions in essential services, as well as economic losses and social impacts. An analysis of the housing conditions in Gujarat urban zones suggests that around 24% of the total urban houses are under livable or dilapidated conditions (good, livable and dilapidated are the three scales based on no repair, minor repair, and major repair respectively) (MoHUPA, 2013).

- **Socio-Economic Vulnerability**: Gujarat urban zones have an incumbent socio-economic issue, owing to the large population influx, due to urbanization. Since urbanization is mostly unplanned, it results in poorly planned settlements. Take the case of Rajkot, where open drainages, a critical driver of epidemics, were common in slum areas(Magotra & Shaw, 2020). The NITI Aayog reports that around 19 % of Gujarat is in poverty (NITI Aayog, 2021). This is significant as the majority of the poor would concentrate in urban zones, and would comprise marginalized castes. Poor and squatter settlements in urban areas of Gujarat are often characterized by inadequate access to basic services such as clean water and sanitation, as well as a lack of safe and secure housing (RBI, 2012). These settlements are also often located in areas that are at high risk of disasters, such as floodplains or steep slopes. As a result, residents living in these settlements are particularly vulnerable to the impacts of disasters and face significant challenges in their day-to-day lives. This can result in exposure to different hazards.

- **Environmental Vulnerability:** Urban areas in Gujarat are highly vulnerable to changes in human and climatic conditions. An analysis of the 2017 floods in Gujarat suggested key vulnerability of the natural drains and depressions of the state, which play a major role in natural water management (Parkash et.al, 2020). This is mainly due to several factors such as unplanned urbanization, inadequate infrastructure, poor waste management, and air and water pollution. Further, due to frequent ongoing development in Gujarat along with the semi-arid condition and moderate to high wind velocity, air-borne dust remains suspended for a very long time, causing an increased concentration of PM10. These can impact the air quality of the environment, and thereby result in hazards.

In conclusion, the risk profile of Gujarat in an urban context is complex, which poses a threat to the systems. Addressing these risks requires a comprehensive approach, including improved planning, investment in infrastructure and safety measures, and increased awareness and preparedness among residents.

**Quiz Time:**
- What are the prominent hazards in Gujarat?
- Which parts of Gujarat are more prone to chemical accidents?
- What are some of the prominent biological hazards?
- Is heatwave impacting Gujarat?
- Which year was the Gujarat State Disaster Management Act implemented?

**Session Plan**

| Content | Trainer's Note | Time |
|---|---|---|
| Hazard Profile of the urban zones | Focus on explaining the hazards, and their reasons, and explain in brief the events represented in the content. Also focus on the impact of climate change | 40 min |
| Key Vulnerabilities | Focus on explaining the vulnerabilities by citing hazard events, and how it was compounded with the incumbent vulnerability. | 10 min |
| Quiz/ Discussion | A quiz on some of the key learning focusing on hazards, vulnerabilities, etc. | 10 min |

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**Additional reading Material**
- IPCC Synthesis Report 2023 https://www.ipcc.ch/report/ar6/syr/

# Notes

# Learning Unit 2.2: Urban Systems and Associated Risks

**Brief Description of the Learning Unit**
The learning unit outlines different urban systems that exist in cities, such as transportation, water supply, energy, and telecommunications systems. It then discusses the challenges associated with these systems, including those induced by natural and human-induced hazards. The purpose of this unit is to underscore the interconnectedness among the urban systems for better understanding and managing the underlying complex and systemic risks therein. By developing this understanding, the unit envisages highlighting the importance of resilience building of critical urban infrastructure and services.

**Learning Objectives**
- To discuss the key urban systems prevailing in the cities and towns of Gujarat and the interconnectedness therein
- To understand the challenges associated with these systems
- To analyze the complex nature of risks associated with urban systems and services through a case study

**Duration**: 60 min

**Methodology**
- Lecture-based discussions
- Group exercise
- Quiz and discussion
- Q&A session

**Detailed Description**
Urban systems refer to the interconnected and interdependent infrastructure, facilities, and services that support the functioning of cities and the well-being of their residents (C40 Knowledge Hub, 2022). These systems can include transportation, water supply, energy, telecommunications, and waste management, among others (ibid.). Urban systems play a crucial role in the day-to-day functioning of cities and urban areas. They provide basic services to the citizens, support economic growth, and ensure the sustainability of urban environments. The study of urban systems is important because cities are rapidly growing in population and are facing a range of challenges related to sustainability, resilience, and social equity.

Understanding how urban systems operate and interact with one another is critical for developing effective policies and strategies that can promote sustainable and resilient urban development. Besides, urban systems are also highly dynamic, constantly evolving in response to changing environmental, social, and economic conditions. This means that effective management of urban systems requires ongoing monitoring, assessment, and adaptation to ensure that they continue to meet the needs of urban populations over time. The unit focuses in sharing key insights on the same. Let us look at the various types of urban systems.

**Types of Urban Systems**
Urban systems consist of the following key systems:
- **Transportation Systems:** According to the 7th Schedule it includes Highways, Railways, Ports. Urban transportation systems are critical components of modern cities, allowing people and goods to move efficiently and safely from one location to another. These systems can include a variety

of modes of transportation, including roads and highways, public transit (e.g. buses and trains), bike lanes, and pedestrian pathways. They consist of:

a) **Roads and Highways:** Roads and highways are the backbones of urban transportation systems. They provide the means for people and goods to move within and between cities. Effective road and highway networks are critical to reducing traffic congestion, improving mobility, and supporting economic growth.

b) **Mass Transit Systems:** Mass transit systems, such as buses, trains, and subways, are essential for reducing traffic congestion and providing efficient and reliable transportation for large numbers of people in urban areas. These systems can also help to reduce air pollution and greenhouse gas emissions by reducing the number of cars on the road.

c) **Bridges and Tunnels:** Bridges and tunnels are critical components of urban transportation systems, connecting different parts of cities and providing efficient transportation options for people and goods. They are also important for improving accessibility, reducing travel times, and supporting economic growth.

Transportation systems in Gujarat consist of a network of roads, highways, and public transit options such as buses and trains. Gujarat has an average 146.50 km Road length per one lac population and Road length per 100 sq. Km. of 38.22 km, as per the roads and building department, Gujarat. The state has over 93700 bridges built along with (Gujarat Roads and Building Department, 2023). The Gujarat State Road Transport Corporation (GSRTC) is responsible for providing bus transportation throughout the state, while the Indian Railways network provides railway connectivity across the country, including in Gujarat. The National Highways Authority of India (NHAI) is responsible for the construction and maintenance of national highways in Gujarat.

• **Water Supply Systems:** Urban water supply systems are complex networks of infrastructure that transport water from sources such as rivers, lakes, and wells to populations in cities and towns. These systems typically include water treatment facilities, pump stations, storage tanks, pipelines, and distribution networks. They consist of the following types:

a) **Water Supply, Distribution, and Treatment Networks:** Urban water supply systems provide clean and safe drinking water to citizens. They include treatment plants, pipelines, and other infrastructure to ensure the delivery of high-quality water to homes, businesses, and public institutions.

b) **Flood Control Network:** In addition to providing water supply, urban water systems must also manage the risk of flooding. Effective flood control systems, such as levees, reservoirs, and drainage systems, help to protect urban areas from damage and reduce the impact of floods on communities.

Water supply systems in Gujarat are responsible for providing clean and safe drinking water to citizens. These systems typically include water treatment facilities, pump stations, storage tanks, pipelines, and distribution networks. The Gujarat Water Supply and Sewerage Board (GWSSB) is responsible for providing water supply and sanitation services to urban areas in the state.

• **Energy Systems:** Energy systems refer to the systems and infrastructure used to produce, distribute, and consume energy within an urban environment. These systems play a crucial role in the functioning of an urban area, as they provide energy for heating, cooling,

transportation, and powering various other essential services such as hospitals, schools, and businesses. Energy systems in urban areas may consist of a combination of different sources of energy, including fossil fuels, renewable energy, and nuclear power. They are usually of two types:

1. **Electricity Generation and Distribution Network:** Electricity generation and distribution systems are critical components of urban infrastructure. They provide the energy needed to power homes, businesses, and public institutions. Effective and efficient electricity systems are essential for supporting economic growth and improving the quality of life in urban areas.

2. **Natural Gas Distribution Network:** Natural gas is an important energy source for heating and cooking in urban areas. Urban natural gas distribution systems must be designed and maintained to ensure the safe and reliable delivery of natural gas to homes, businesses, and institutions.

> Energy systems in Gujarat provide energy for heating, cooling, transportation, and powering various other essential services such as hospitals, schools, and businesses. Gujarat is a leader in renewable energy in India, with a significant portion of its energy coming from sources such as solar and wind power. The Gujarat Energy Transmission Corporation Limited (GETCO) is responsible for the transmission of electricity in the state.

- **Communications Systems:** This involves telephone and internet networks, which play a vital role in the functioning of urban areas. They support economic growth by providing businesses and institutions with reliable and efficient means of communication. They also improve the quality of life for citizens by providing access to information and opportunities for social interaction.

> Telecommunications systems in Gujarat consist of telephone and internet networks. The state has a well-developed telecommunications infrastructure, with a variety of service providers offering mobile, landline, and internet services. The Telecom Regulatory Authority of India (TRAI) is responsible for regulating the telecommunications sector in India

**Challenges Associated with Urban Systems**

While urban systems form the critical section for societal functioning, it is faced by various challenges, which are incumbent and emerging. Due to their interdependence, failure in one system can have a cascading effect on other systems, leading to widespread disruption and even disaster. Therefore, it is essential to understand these risks further. There are several types of challenges associated with urban systems, including

- **Challenges to the Physical Infrastructure:** This includes natural and anthropogenic hazards such as earthquakes, hurricanes, floods, and fires that can damage or destroy critical infrastructure and disrupt services. The 2005 Mumbai floods, for example, resulted in widespread damage to transportation, water supply, and energy systems, leaving many residents without access to essential services (UNDRR, 2021). The disruption of the road transportation system during the Mumbai floods in 2005 affected approximately 1.5 lakh people, according to the fact-finding committee on Mumbai Floods (Chitale et al., 2006). This had a significant impact on the city's economy, as businesses were unable to operate and people were unable to reach their workplaces. The transportation network is critical for the functioning of the city, with people relying on it to reach their destinations such as work, school, and healthcare facilities. Further, these are influenced by administrative policies, as the failure to comply with laws such as seismic building codes and so on, exacerbates the impacts. Besides, these are influenced by climate change which results in the increased

frequency of these hazards. E.g.: Cyclones form one of the most important impacts of climate change. It is reported that under 2.5°C of global warming, the most devastating storms are projected to occur up to twice as often as today, resulting in impacting multiple systems.

- **Cyber Technological/ Digital Challenges:** This includes issues associated with cyber technology failures, such as power outages, gas leaks, and data breaches due to cyber-attacks. For example, the WannaCry ransomware attack (Kaspersky, 2023) in 2017 impacted more than 150 countries and infected over 200,000 computers, causing widespread disruption to essential services such as hospitals, banks, and transportation systems. The reported impact of the WannaCry ransomware attack on the District Administration Collectorate Office in Vadodara, Gujarat caused concern, as it concerns the legislation and other legally binding information that can impact service delivery. The attack highlights the vulnerability of government organizations and critical infrastructure to cyber threats.

- **Interconnected systems** within a city are prone to risk due to failure in one system failure leading to cascading failures in other systems (Pescaroli & Alexander, 2015). For example, during the 2011 Tohuku Triple Disaster in Japan, the impact on the power sector was influenced by the failure of the flood control network(Suppasri et al., 2021). The below figure shows a case of the interconnected impact of transportation on other sectors:
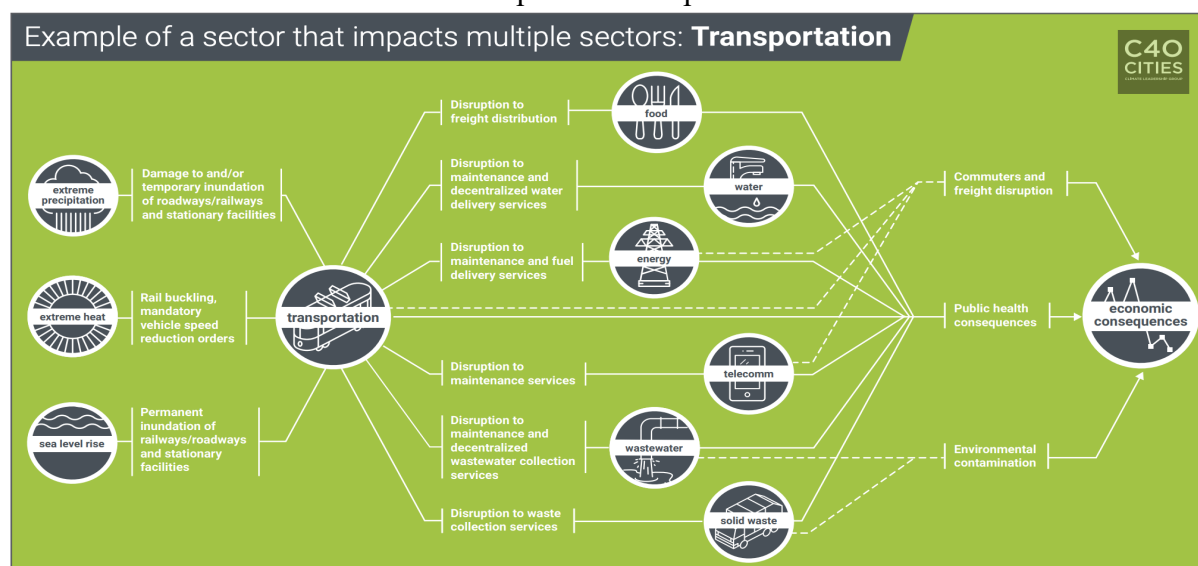


*Fig 1. Impact of transportation on multiple sectors (C40 Knowledge Hub, 2023)*

**Issues in Mapping the Interconnectedness among the Urban Systems:**

While there is a need for understanding and managing interconnected systems, mapping interconnectedness among these systems in urban areas can be challenging for several reasons. Some of the issues include

- Complexity: Urban systems are complex and involve multiple interconnected systems such as transportation, water, energy, and telecommunications. Mapping the interconnections between these systems requires a deep understanding of their workings, which can be difficult to obtain (Taylor & Howden-Chapman, 2021; UNDRR, 2019).

- Data Availability: Mapping interconnected systems also requires access to accurate and up-to-date data, which can be challenging to obtain in many cases. This can be due to the lack of data standardization, data privacy concerns, and limitations in data collection technologies. (UNDRR, 2019)

- Lack of Integration: In many cases, the systems within an urban area are not integrated, meaning that data and information are not shared effectively between different departments and agencies. This can make it difficult to get a complete picture of how the systems are connected.
- Interdisciplinary Approach: Mapping interconnected systems requires an interdisciplinary approach, involving experts from multiple fields such as engineering, computer science, and urban planning (UNDRR, 2019). This can be challenging because these experts may have different perspectives and approaches, making it difficult to achieve a common understanding of the systems.
- Time and Resource Constraints: Mapping interconnected systems can be a time-consuming and resource-intensive process, requiring significant investment in data collection, analysis, and mapping technologies.

Several approaches can assist us in better understanding the interconnectedness and interlinkages of urban systems. One of the key approaches is by utilizing a systems approach. In this approach, the urban system is viewed as a complex and interconnected web of subsystems. It seeks to comprehend the relationships and feedback loops that exist between these subsystems, as well as how they interact with one another. It entails mapping out the various components of the urban system and analyzing their interactions to identify key change drivers and potential vulnerabilities. (OECD Global Science Forum, 2011)

Another growing approach is the spatial approach for mapping interconnected systems. The approach focuses on the physical and spatial dimensions of urban systems. It seeks to understand how the layout and design of urban spaces shape the interactions between people, communities, and infrastructure. It involves analyzing spatial data and using tools such as GIS to visualize and map out urban systems. Other approaches such as the Participatory approach, whereby involving communities and stakeholders in the process of understanding and managing urban systems.

**Case Study on Complex Risks in Interconnected Urban Systems-** Tohoku Triple Disaster of 2011 (Japan):
The Tohoku Triple Disaster of Japan was a catastrophic event that occurred on March 11, 2011, which consisted of a 9.0 magnitude earthquake, a subsequent tsunami, and a nuclear disaster (Schweizer, 2019; UNDRR, 2019). The disaster affected many aspects of the urban systems in the affected area, particularly in the city of Fukushima. The earthquake and the tsunami caused significant damage to the transportation system, such as roads, bridges, and port facilities (ibid.). The damage to the water supply system resulted in disruptions in the supply of clean water and sewage management, causing health risks to the population. The energy systems, particularly the nuclear power plant in Fukushima, were also severely impacted, causing a release of radioactive material and leading to a long-term impact on the environment and the health of the local population.

The impacts of the disaster on the urban systems were exacerbated by the interactions between them (Schweizer, 2019; UNDRR, 2019). For example, the damage to the flood control systems resulted in the damage to the energy sector, resulting in radioactive contamination. The damages caused by the Tohoku Triple Disaster were substantial, with estimates of the total cost ranging from $235 billion to $360 billion. The impact on the affected population was significant, with more than 15,000 lives lost, and hundreds of thousands of people being displaced from their homes. The environmental impact of the disaster, particularly the release of radioactive material

from the Fukushima nuclear power plant, is still being felt today and will continue to impact the affected areas for many years to come.
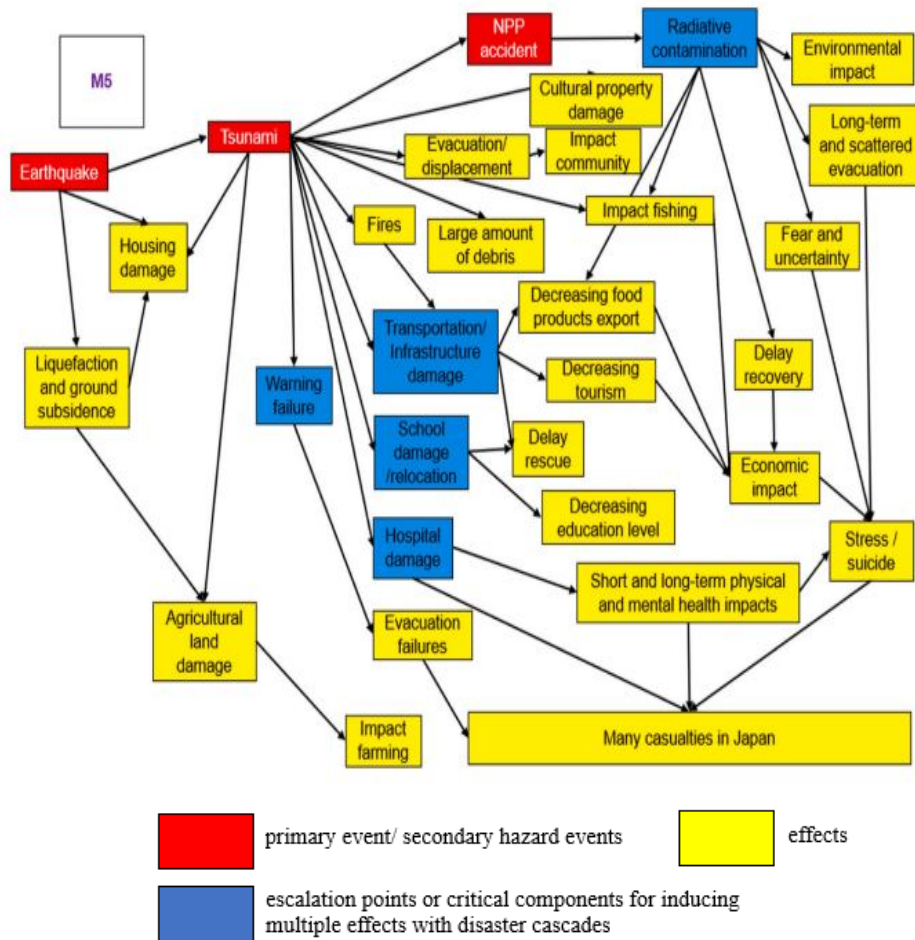


*Fig 2. Schematic Representation of Hazards, Effects and Escalation Points (Supprasi et.al, 2021)*
*M5 are high-magnitude incidents with multiple causes, multiple chains of effects and multiple escalation points. Nuclear Power Plant (NPP) accident*

Three key takeaways from the perspective of urban systems risk management can be drawn from the **Tohoku Triple Disaster**:

a) Importance of robust infrastructure: The damage caused by the earthquake and tsunami showed that urban systems need to be built with resilience in mind, to withstand the effects of disasters. This includes investing in robust transportation systems, water supply systems, energy systems, and telecommunications networks.

b) A high degree of interconnectedness of urban systems: The disaster demonstrated the high degree of interconnectedness between different urban systems and how the failure of one system can have a significant impact on the others. This highlights the importance of considering the interdependence of urban systems when developing risk management strategies.

c) Need for integrated risk management: The disaster also highlighted the importance of integrated risk management, which considers the interactions between different urban systems and takes into account the potential impact of one system's failure on others. This requires coordination between different government agencies, and the private sector, to ensure that risk management strategies are integrated and effective in addressing the complex challenges posed by large-scale disasters

## Conclusion

In summary, the interconnections and interdependencies between urban systems are complex and multi-layered, and the effective functioning of one system is often dependent on the effective functioning of other systems. This highlights the need for ongoing monitoring, maintenance, and coordination between the different organizations and agencies responsible for the various systems.

## Session Plan

| Content | Trainer's Note | Time |
|---|---|---|
| Urban Systems, importance, and its types | Focus on explaining urban systems, its requirement, and the different types of urban systems | 10 min |
| Challenges in Urban Systems and Issues in Mapping | Focus on explaining the challenges in deep, and discuss the figures, to give the learners, a sense of the interconnections and their impacts.<br>Also, explain in detail what challenges deter the mapping process | 25 min |
| Case Study | Focus on promoting the knowledge of key interdependencies, and their impact | 15 min |

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**Additional Reading Materials**
- Global Assessment Report, 2019 https://gar.undrr.org/report-2019.html
- A definition of cascading disasters and cascading effects : Going beyond the " toppling dominos " metaphor, by Luis Pescorali, and Alexander
- https://www.preventionweb.net/publication/definition-cascading-disasters-and-cascading-effects-going-beyond-toppling-dominos

# Notes

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# Learning Unit 2.3: Case Study/Group Exercise - Interdependencies of Urban Systems

## Brief Description of the Learning Unit
Having understood the complex interactions and connectedness among the urban systems and associated underlying risks, the learning unit aims to identify such interconnections in varied urban systems of Gujarat and map the associated risks, with the help of a case study.

## Learning Objectives
- To demonstrate the interdependence and connectedness of urban systems and associated risk through the case study of the Mumbai Flood 2005
- To encourage learners to think critically about the interactions and connectedness among the urban systems in Gujarat
- To enable the learners to map the potential risks associated with these interactions and connectedness

**Duration:** 60 minutes

## Methodology
- Reading and discussion
- Group exercise

## Detailed Description
The case study aims to promote a group exercise of mapping interdependencies of urban systems by utilizing the case study of Mumbai Floods, 2005. The learners would be given a hypothetical scenario based on the case study to identify interconnections among the systems and map the associated risks.

**Case Study:** The Mumbai Floods of 2005
Mumbai, also known as the financial capital of India, is one of the largest and most populous cities in the country. Mumbai is located on the west coast of India and is surrounded by the Arabian Sea (Government of Maharastra, 2023). The city is well connected to other parts of India and the world through a well-developed transportation network, including a port, an international airport, and a railway network. The city is located in the state of Maharashtra and is the capital of the Mumbai Metropolitan Region, one of the largest urban agglomerations in the world (ibid.). The city holds high regard in Indian economics. The city is home to the Bombay Stock Exchange, the Reserve Bank of India, and several major banks and financial institutions. The film industry, also known as Bollywood, is a significant contributor to the economy of Mumbai and the state of Maharashtra. The city also has a growing start-up ecosystem, with several incubators and accelerators providing support to young entrepreneurs.

While being a city of economic importance, the city has critical challenges in environmental aspects. Mumbai is located on the coast and is vulnerable to natural hazards such as floods and cyclones (MCD, 2019). The city also faces environmental issues such as air pollution, water pollution, and waste management. The rapid pace of development in recent years has led to the destruction of mangroves, forests, and other important habitats, affecting the city's biodiversity (MCD, 2019). The city also faces a shortage of open spaces and parks, leading to a lack of green spaces for residents. The case study discusses the 2005 Mumbai Floods, which occurred and disrupted the overall functioning of the city, and the country's stock exchanges.

The 2005 Mumbai floods resulted from heavy rainfall that overwhelmed the city's drainage system. The drainage system has been deemed old dating from the British era, with reports suggesting they were at least 100 years old (Stecko & Barber, 2007). The city received extremely heavy rainfall of around 944 mm in just 24 hours, on 26th July 2005 (Chitale et al., 2006). This

extreme rainfall event broke previous records and was described as the highest rainfall ever recorded in a single day in the city. The heavy rainfall caused widespread flooding and resulted in the loss of life, damage to infrastructure, and disruptions to essential services such as transportation, energy, and water supply. Around 22% of Mumbai was waterlogged due to this (Chitale et al., 2006). The interdependencies among the following systems were highlighted, with a failure in one system leading to disruptions in others.

- **Transportation:** The floods disrupted the transportation network, causing roads to be closed and trains to be canceled. The fact-finding committee on Mumbai Floods (Chitale et al., 2006) estimated that approximately 1.5 lakh people were affected by the disruption of the road transportation system. The transportation network is critical for the functioning of the city, with people relying on it to reach their destinations, such as work, school, and healthcare facilities. The failure of the transportation network had a significant impact on the city's economy, with businesses being unable to operate and people being unable to reach their workplaces. The reason for the failure of the transportation system was the poor drainage and flood management systems in the city. The inadequate drainage systems were unable to cope with the heavy rainfall, leading to flooding of roads and railway tracks (ibid.). The floods also resulted in power cuts, which affected the operation of the transportation system.

- **Water Supply and Drainage Management:** The floods affected the water supply system and drainage, with several water treatment plants being shut down due to power cuts and flooding. The fact-finding committee on Mumbai Floods (Chitale et al., 2006) stated that high-density zones of the city such as Andheri, and Kurla, were affected by the disruption of the water supply system. The failure of the water supply system resulted in water shortages and contamination due to dirty water flowing into the pipes, affecting the health of the residents. It was reported that over 3 lakh patients needed to be addressed through health camps and outreach programs, as a result of diseases from various including water contamination. The reason for the failure of the water supply system was due to inadequate infrastructure and planning, as the systems were 100 years old (Stecko & Barber, 2007). The water treatment plants were located in low-lying areas, which made them vulnerable to flooding. The power cuts caused by the floods also affected the operation of the water treatment plants.

- **Waste Management:** The floods caused an increase in the amount of waste generated, and the city's waste management system was unable to handle the additional load. The fact-finding committee on Mumbai Floods (Chitale et al., 2006) estimated that approximately 0.2 million ton of waste was generated during the floods. The failure of the waste management system and closure of landfill sites due to floods resulted in waste being left uncollected, leading to public health and environmental problems, with over 3 lakh people reported visiting health centres post the flood for various diseases.

- **Energy:** The floods affected the energy system, with power cuts affecting both the supply and distribution of electricity. The fact-finding committee on Mumbai Floods suggested millions were affected by the power cuts. The failure of the energy system had a cascading effect on other systems, as seen in the case of the transportation and water supply systems. The failure of the electric supply impacted the pumping stations for water supply, thereby impacting the Kalina, Kurla, andheri, Borivali, Bhandup, and Mulund, residents. The reason for the failure of the energy system was inadequate infrastructure and planning. The power generation and distribution systems were located in low-lying areas below 1 in 100 years flood level ('1-in-100-year flood' refers to a flood height that has a long-term likelihood of occurring once in every 100 years), making them vulnerable to flooding (Chitale et al., 2006). The power cuts caused by the floods also affected the operation of essential services, such as hospitals and water treatment plants.

## Group Activity
Based on this exercise, the learners should map Vadodara city's interdependencies on urban systems,

and then draw a Schematic Representation of hazards, effects and escalation points (this is an illustrative example and the details could be upon the team's deliberation), by taking into consideration cyclones, earthquakes and floods.

The following details could be utilized to undertake the exercise. It is to be noted that this is to draw ideas and more integration can be done from the learners'/teams' end. Vadodara is prone to strong winds, floods, and earthquakes. The months of May to November require preparation against cyclones. Weak construction, especially weak and connected roofs or ceilings, contributes to the loss of properties due to strong winds. Low-lying and poorly-drained areas become water-logged during floods, with the Vishwamitri River being a major source of floodwater. The water is decreasing in the Aajwa reservoir which happens to be the main source of water supply to the city. Vadodara falls under seismic zone-3, and high-rise buildings, old or defective constructions, and huts with mud walls are at high risk of damage during earthquakes. Areas with less open space in their surroundings are also more vulnerable to the impact of earthquakes (GSDMA, 2023)



*Fig 1. Vadodara during Floods (Indian Express, 2019)*

The following steps need to be undertaken as a part of the exercise:
1. Divide the learners into groups of 3-5 members.
2. Introduce the topic of the Mumbai floods of 2005 and explain how the interconnected systems failed, leading to one of the worst disasters in the city's history.
3. Based on the exercise, ask each group to identify and list the interconnected systems that could impact urban resilience in the Gujarat city of Vadodara in the event of a similar disaster.
4. Once the groups have identified the interconnected systems, ask them to draw a Schematic Representation of hazards, effects and escalation points (similar to Supprasi et.al, 2021), linking the systems to each other and the impact on urban resilience.
5. Ask each group to present their findings to the rest of the class and facilitate a discussion on the similarities and differences between their models.
6. Finally, conclude the exercise by discussing the importance of understanding the interconnected systems and their impact on urban resilience, and the need for a comprehensive approach to urban planning and management.

**Conclusion**

The 2005 Mumbai floods highlighted the interdependencies of urban systems, with a failure in one

system having a cascading effect on others. The floods demonstrated the importance of adequate infrastructure and planning in managing urban systems, as well as the need for resilience and sustainability in cities. The case study highlights the need for cities to adopt an integrated approach to urban planning, considering the interdependencies of various systems to prevent or mitigate the impacts of disasters. Further, the exercise would help in understanding the importance of understanding the interconnected systems and their impact on urban resilience, and the need for a comprehensive approach to urban planning and management

## Session Plan

| Content | Trainer's Note | Time |
|---------|----------------|------|
| Case Study | Focus on understanding urban systems, their interdependencies, and their impact | 20 min |
| Group exercise | Promote a discussion asking them to map the selected city based on the case study, by following the steps mentioned | 40 min |

## References

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- Stecko, S., & Barber, N. (2007). Exposing Vulnerabilities : Monsoon Floods in Mumbai , India. Case study prepared for Revisiting Urban Planning: Global Report on Human Settlements 2007. 1–14.

## Additional Reading Materials

- Exposing Vulnerabilities: Monsoon Floods in Mumbai, India Stacey Stecko and Nicole Barber https://unhabitat.org/sites/default/files/2008/07/GRHS.2007.CaseStudy.Mumbai.pdf

# Notes

## Summary

The Technical Session 2 guides the learners on:

- The detailed risk profile of Gujarat and how it affects the urban systems
- Key types of urban systems like transportation, electricity supply etc. and their interconnected nature
- Prevalent impacts of disasters on the urban systems and ways to engage in minimizing risks through robust infrastructures and interconnected systems
- Integrated risk management aspects through the use of case studies that allow learners to map potential risks, effects and escalations-like aspects in a realistic scenario.

# Technical Session 3: Urban Resilience, Framework for Urban Resilience: Case Studies, Methodologies and Tools

## Introduction, Overview & Perspectives

The technical session offers to introduce the learners to the key concepts of urban resilience while developing familiarity with terminologies used in DRR. The session would delve into urban resilience, disaster risk reduction concepts in the urban context, the components of urban resilience, characteristics of a resilient city, existing urbanization trends and challenges in the state of Gujarat. It offers knowledge on urban systems, the importance of urban planning in disaster risk reduction, and ways for urban disaster risk reduction. Overall, this session provides fundamental knowledge to step up and embrace urban disaster risk reduction while utilizing urban planning and resilience assessment tools and strengthening urban resilience.

The learning units of this session are as follows:
- Learning Unit 3.1: Urban Resilience and its Components
- Learning Unit 3.2: Key Frameworks for urban resilience
- Learning Unit 3.3: Tools for resilience analysis
- Learning Unit 3.4: Group exercise on resilience tools

The primary objectives of this technical session are:
- To have a better perspective to handle urban risks
- To enhance knowledge of frameworks on urban resilience and strategies to develop resilient cities
- To familiarise with globally accepted resilience assessment tools

## Duration: 210 minutes

## Methodology
- Lecture-based learning
- Case study-based learning
- Group exercises
- Q&A session

**Trainer's Note**

This technical session consists of three learning units and a group exercise. It should be conducted to provide a basic conceptual clarity about key dimensions of urban resilience, frameworks and tools used in urban settings. The trainer should aim for an understanding of each of the concepts covered through the active participation of learners through discussion and question-and-answer sessions. It is to be ensured that the learners are able to grasp the common tools for resilience analysis. This should let learners assess city-wide resilience and priorities for interventions. The explanation should be strengthened with as many cases, examples, evidence, group activities and visual aids as possible. It is recommended that while explaining and using case studies, and examples on the same, trainers strive to link the general concepts to the urban contexts of Gujarat.

# Learning Unit 3.1: Urban Resilience and its Components

**Brief Description of the Learning Unit**

This unit introduces learners to the key concepts of urban resilience. It explains different dimensions of urban resilience and strives to underscore how they are being addressed through varied ongoing urban development schemes, projects and initiatives in India and Gujarat. It delves into the aspects to integrate resilience into a city's systems when urbanization puts pressure on the available resources. It develops an understanding of the concepts important for furthering the implementation of sustainable development goals and integrated urban development planning.

**Learning Objectives**

- To understand the concept of urban resilience and its components
- To acknowledge the importance of resilient cities for long-term sustainability

**Duration**: 30 minutes

**Methodology**

- Lecture-based learning
- Audiovisuals
- Discussion

**Detailed Description**

Urban population is heavily reliant on the interconnected urban systems and infrastructure as discussed in the previous session. The damage to it caused by disasters, stresses or shocks of any kind can lead to disproportionate financial and humanitarian impacts. Instances like the floods of 2005, in which the city of Ahmedabad experienced severe flooding due to heavy monsoon rains resulted in significant damage to infrastructure, homes, and businesses, and the loss of 124 lives (PIB, 2005); emphasizes the need for resilience in urban areas. Resilience in urban settings requires a multifaceted approach that involves various stakeholders, including government agencies, private sector entities, and community organizations. It involves building resilience through a combination of physical infrastructure, social networks, and economic systems that can absorb and adapt to shocks while continuing to provide critical services and support to the affected population.

According to the UNDRR Resilience is defined as "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management." It is built on three types of capacities that support enabling resilience in a city:

- Absorptive - the ability to absorb shocks. Eg. retrofitting buildings are more capable to withstand disasters, actions that increase resistance to changes, hazard-proofing buildings, planning for mitigation measures etc.
- Adaptive - ability to make proactive choices depending on changing conditions. Eg. adoption of scientific agricultural practices, behavioural changes, risk financing options etc.
- Transformative - Improve the prevalent conditions through policy changes, plan implementation, governance mechanisms etc. Eg. Revision of building codes after the Bhuj earthquake in 2001, provision of access to basic services, etc.

UN-Habitat Urban Resilience Lab, defines Urban Resilience as "The measurable ability of any urban system, with its inhabitants, to maintain continuity through all shocks and stresses, while positively adapting and transforming toward sustainability."

In cities, separate departments and organizations focus on land, food, water, finance, building regulations, technology, health etc. which often leads to disconnected silos of activity. One good example of intervention by engaging multiple government stakeholders was observed in Kochi's 'Operation Breakthrough 'where a technical committee involving experts from various government departments identified the causes for flooding in the city. This was followed by implementing the resilience actions identified by the technical committee.

Resilient cities are built on systems that are open and interconnected in their interventions. Some of the key characteristics of resilient cities are listed in Fig 1.
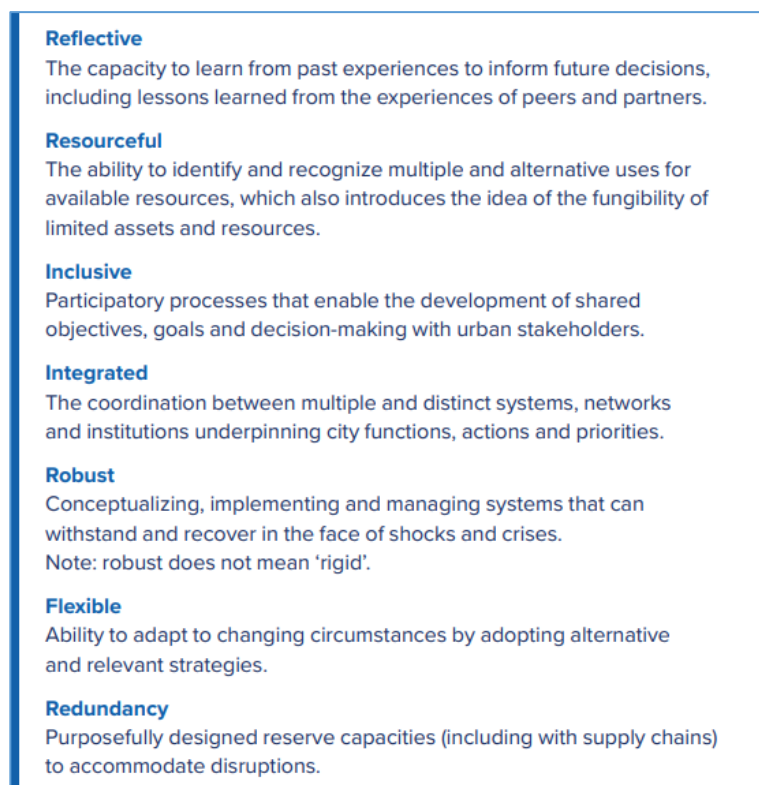


**Reflective**
The capacity to learn from past experiences to inform future decisions, including lessons learned from the experiences of peers and partners.

**Resourceful**
The ability to identify and recognize multiple and alternative uses for available resources, which also introduces the idea of the fungibility of limited assets and resources.

**Inclusive**
Participatory processes that enable the development of shared objectives, goals and decision-making with urban stakeholders.

**Integrated**
The coordination between multiple and distinct systems, networks and institutions underpinning city functions, actions and priorities.

**Robust**
Conceptualizing, implementing and managing systems that can withstand and recover in the face of shocks and crises.
Note: robust does not mean 'rigid'.

**Flexible**
Ability to adapt to changing circumstances by adopting alternative and relevant strategies.

**Redundancy**
Purposefully designed reserve capacities (including with supply chains) to accommodate disruptions.

*Fig 1: Characteristics of a Resilient City (UNDP, 2021)*

Addressing the existing risk in the context of resilience encourages urban practitioners to look at the impacts of disasters and build the long-term capacity of communities. Urban resilience can be better understood by studying its key components, namely, economic, environmental, institutional, infrastructural and social (World Bank 2012, Sarker et al., 2020).

*Fig 2. Components of urban resilience*

*Table 1. Components of Urban Resilience and considerations*

| Component | Key considerations | Examples |
|---|---|---|
| Social | Social capital (sense of community, the ability of groups of citizens to adapt and a sense of attachment to a place) Demographic profiles (identified through sex, age, ethnicity, disability, socio-economic status, and other groupings) | With an understanding of women engaged in the informal sector, required interventions to develop inclusive plans and build the capacity of vulnerable groups can be achieved. |
| Institutional | Efficient management of governmental and non-governmental systems that assist communities. | Projects like Gujarat State Highway Project (GSHP) during 2001-07 through its effective planning activities led to a reduction in the backlog of major maintenance and constructed an improved network. Another instance is the redeployment of Octroi staff in departments with shortages at places like Navsari municipality during the early 2000s after the state abolished Octroi for municipalities. |
| Economic | Employment options, formal and informal sector investments, and credit funding mechanisms Implementing policies for increasing local authorities' access to financing DRR projects Scaling of good practices on urban efficiency, and economic success. | Tax-free bonds for infrastructure development as part of urban and economic reforms were introduced in Ahmedabad municipal corporation through which under the private partnership model basic services infrastructure like water supply and sewerage systems were developed. Vadodara issues municipal bonds with assistance from the US Treasury Department's Office of Technical Assistance. The bond will provide funds for infrastructure projects. |
| Infrastructural | reduction in the vulnerability of built structures using effective building designs, increasing capacity by improving shelter facilities, health care facilities, critical infrastructure, and roads networks | Proper infrastructures like integrated command and control centres, effective early warning systems, emergency disaster response, and post-disaster recovery etc. Using Information and Communication Technologies (ICT), GIS maps, and e-Governance for improving decision-making and maintaining transparency. Efficient land management using spatial data analysis through GIS can add value to resilience. |
| Environmental | Urban growth in the long run impacts the climate | Low-carbon projects are essential to promote environmental resilience. Projects that promote revitalizing water bodies, and open green spaces can enhance environmental resilience |

*Some examples are from the City Manager's Association Gujarat. Instructors may use examples from their experience for a better understanding*

Under the recent Urban20 (U20) actions at the city level that can drive lasting positive outcomes are to be emphasised. Its key priorities like encouraging environmentally responsible behaviors, accelerating climate finance, and leveraging local potential and identity directly relate to the SDGs and urban resilience building practices. Resilience is regarded as a characteristic of the urban system that can support sustainability which is a societal goal. Sustainability refers to the desire for long-term

benefits which requires strategies and tactics that can react quickly and effectively within stipulated time scales, allowing for timely recovery and building back better. Thus, it can be considered that urban resilience is critical for attaining sustainability in an urban setting.

**Discussion**

The instructor will play the following videos for the learners followed by a short discussion.

Video: What is urban resilience? by 100 Resilient Cities **https://youtube.com/watch?v=v8u9BJDuIrY&si=EnSIkaIECMiOmarE**

Keywords to be noted by the learners: the ability to **survive, adapt and grow;** chronic stresses and acute shocks; **assessing and understanding** challenges and finding solutions holistically. It briefly talks about initiatives undertaken in the cities of Da Nang, Vietnam, and Medellin, Colombia.

Video: What works to make cities more resilient? By Independent Evaluation Group World Bank Group **https://www.youtube.com/watch?v=1OC0CA-Sobg**

Keywords to be noted by learners: shared understanding of the term "resilience", chronic stresses, **building urban resilience, and people-centric approaches**. The instructor may ask the learners to identify the opportunities (infrastructural, institutional, social, economic, environmental) to create more resilient systems for the future.

**Drecca Susdev**: It may seem far-fetched to manage complicated hazards while also controlling day-to-day activities and promoting socioeconomic progress. In addition, it can be challenging to picture achievement in the context of so many demands. GAR provides an illustrated scenario of the fictional coastal delta city of Drecca-Susdev, which has adopted a systems approach to risk management, to address this issue. It is selected and might even seem futuristic, but it is founded on serious expert consideration and offered as a creative exercise for "the future we want."
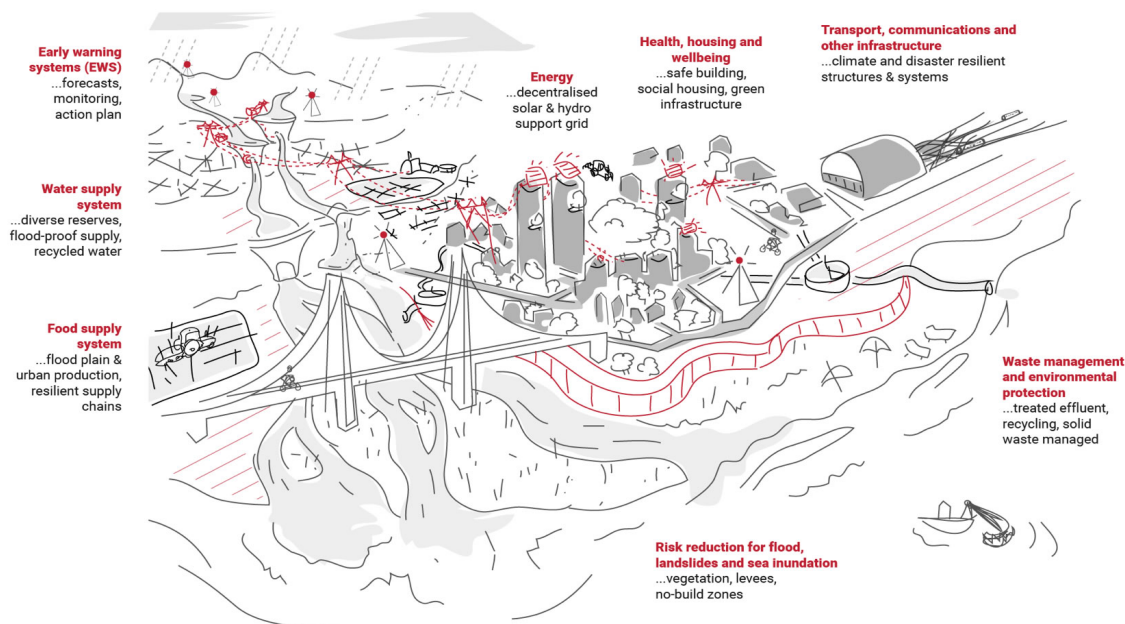


*Fig 3. Drecca Susdev Risk Management (GAR, 2019)*

**Session Plan**

| Content | Trainer's Note | Time |
|---|---|---|
| Definition of key terms | Focus on explaining the concept of urban resilience and resilient city | 10 min |
| Components of urban resilience | Detail out the components of urban resilience with examples of local practices | 10 min |
| Video and discussion | A group activity with teams identifying risks, needs and actions to improve resilience. | 10 min |

**References**

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**Additional Reading Material**

- ADB (2016). Reducing Disaster Risk by Managing Urban Land Use https://www.adb.org/sites/default/files/publication/185415/disaster-risk-urban-land.pdf
- De, Indranil, Mukul Kumar and H. S. Shylendra (2017), A Report on Female Workers in the Unorganized Sector: A Study in Slums of Bhuj City, Kutch, Anand: Institute of Rural Management Anand
- Urban governance good practices in Gujarat http://www.cmagindia.org/best_pratice_program.html

# Notes

# Learning Unit 3.2: Key Instruments for Urban Resilience

## Brief Description of the Learning Unit

This learning unit is designed to familarise the learners with key frameworks and global initiatives on urban resilience so as to better inform and equip them to assess, plan and enhance resilience in urban areas of Gujarat. It discusses different frameworks for assessing urban resilience, such as the City Resilience Framework, and explores a case study of Indian cities that have implemented successful resilience strategies. By completing this learning unit, learners will gain a better understanding of the importance of urban resilience and the tools and strategies that can be used to build more resilient cities.

## Learning Objectives

- To provide an overview of different frameworks for urban resilience and their key components
- To explore an example of Indian cities which have implemented urban resilience frameworks

## Duration: 60 minutes

## Methodology

- Lecture-based learning
- Discussion
- Case-study based learning

## Detailed Description

There have been many instruments and frameworks that have focused on urban resilience post the Hyogo and Sendai Frameworks. The key frameworks have been discussed below:

- **The UNISDR's Ten Essentials for Making Cities Resilient (2010)**

This framework was developed by the United Nations Office for Disaster Risk Reduction (then UNISDR) in 2010 to guide local governments in building resilience to disasters (UNDRR, 2010). Developing institutional capacity, enhancing community participation and social inclusion, ensuring robust infrastructure and services, promoting ecosystem-based approaches, investing in resilient urban land use, improving disaster response and preparedness, promoting effective communication and information exchange, and strengthening partnerships are among the essentials. Cities can better prepare for and withstand disasters and other shocks by adhering to these essentials, allowing them to thrive in adversity.

The framework's ten essential action areas included indicators such as the number of households with emergency kits and the percentage of critical infrastructure with risk reduction measures. The key impact of this framework was improved coordination and collaboration among stakeholders in building urban resilience. The Addendum on Public Health System was added in 2018 to evaluate the condition of public health infrastructures, the extent to which public health emergencies and disasters are included in risk management planning etc. It is critical during post-disaster situations to assess the capacities and availability of facilities to support public health.
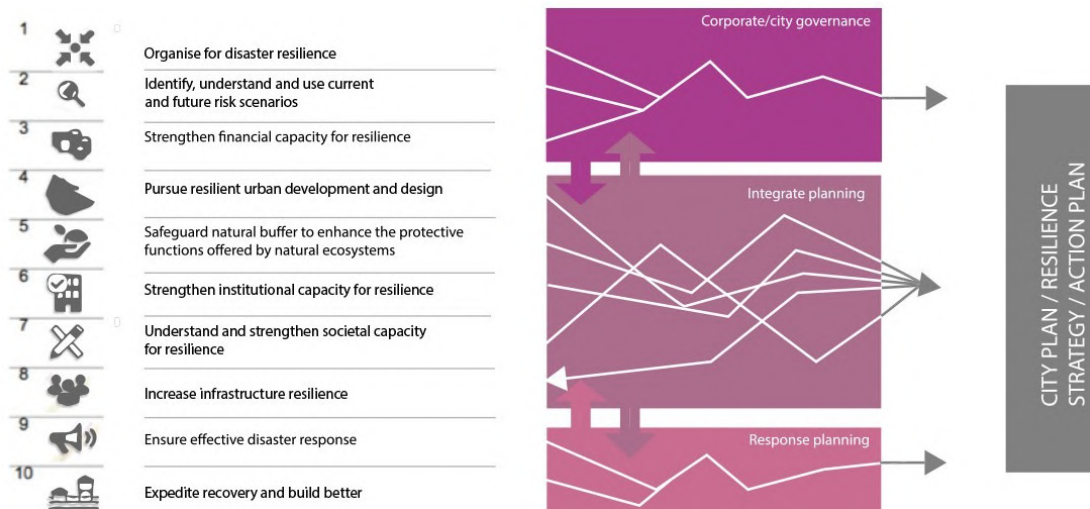
*Fig 1. The UNISDR's Ten Essentials for Making Cities Resilient (2010) (UNDRR, 2010)*

- **Rockefeller Foundation's The City Resilience Framework (2015)**

The Rockefeller Foundation has been at the forefront of global urban resilience and has pioneered many initiatives such as 100 resilient cities or 100 RC (Surat city, India is a part of the 100 RC), Asian Cities Climate Change Resilience Network (ACCRN) and so on. Released by the Rockefeller Foundation in 2015, the City Resilience Framework (The Rockefeller Foundation, 2015) aimed to provide a comprehensive framework for building urban resilience in cities, for spearheading the initiatives of the Rockefeller Foundation. The framework was designed to help cities assess their resilience to a range of shocks and stresses, including natural hazards, economic downturns, and social unrest. The framework consists of 4 key categories, including

o   Health & well-being
o   Economy and society
o   Infrastructure & Environment
o   Leadership & strategy

Key indicators covered in this framework included the availability of integrated health facilities and services, and responsive emergency services, the quality of infrastructure and public services, and the strength of community networks and institutions. The City Resilience Framework has had a significant impact on urban resilience efforts globally, leading to the development of the City Resilience Index, as a part of the framework, and being implemented in various parts of the world, such as India.
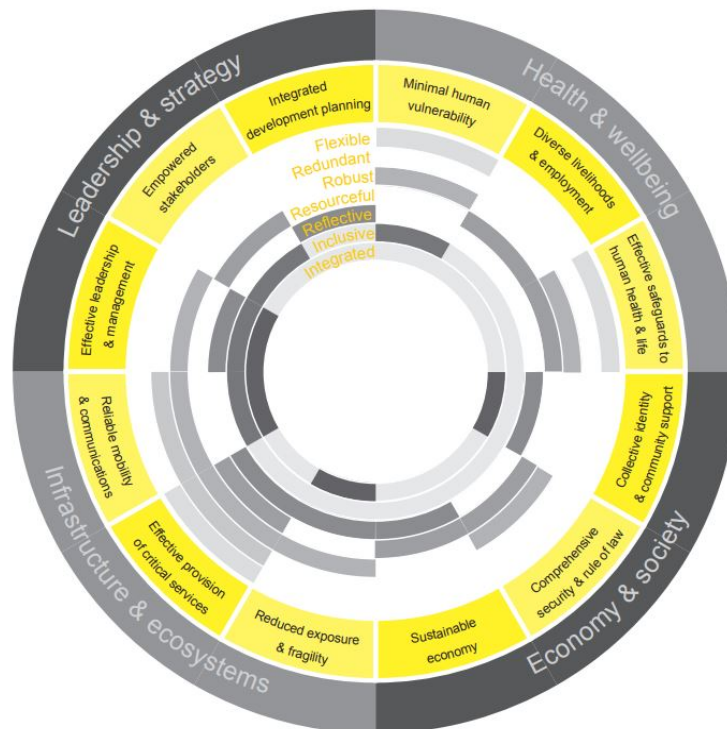
*Fig 2. City Resilience Framework (The Rockefeller Foundation, 2015)*

- **Action Framework for the New Urban Agenda (NUA) (2016)**

The New Urban Agenda was adopted at the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in Quito, Ecuador in 2016. The NUA provides a roadmap for creating sustainable and resilient cities that can withstand the challenges of urbanization, climate change, and natural hazards.

The Action Framework for the Implementation of the New Urban Agenda (AFINUA) is a flexible framework that outlines 35 essential elements for sustainable urbanization (UN-Habitat, 2018). The framework is aimed at governments that are both unconvinced and under-resourced to make the implementation of the New Urban Agenda more concrete and approachable. The key elements are grouped into five categories: national urban policies,

o Urban Legislation,
o Rules and Regulations,
o Urban Planning and Design,
o Urban Economy, and Municipal Finance
o Local Implementation

The five categories cover all 35 key elements as per the framework and consist of indicators such as mechanisms for urban population projection, the establishment of laws for urban spaces, and so on. UN-Habitat leads a mapping of interests and services to articulate a consolidated offering of the UN System and other stakeholders in support of UN Member States. The framework includes a focus on urban planning, housing, infrastructure, transport and social inclusion.

- **The Integrated Urban Resilience (IUR) Framework, 2020**

The Integrated Urban Resilience (IUR) framework was developed by the UNDP Asia Pacific Bangkok Regional Hub in 2020 (UNDP, 2021) to address the growing urban resilience challenges in the Asia Pacific region. The framework adopts a systems approach and defines the 'urban system' as interconnected institutions, functions, assets, and resources with multiple and overlapping

stakeholders. The framework identifies nine functional layers that work together to mediate and regulate various flows in cities. These functional layers include urban governance, land-use planning and land markets, built environment standards, infrastructure and services planning, circulation, networks and linkages, the spatial distribution of human activities, natural resource management, own revenue generation and finance, and public safety and security. (ibid)

The IUR framework aims to address the extensive urban risks that correlate strongly with poverty, inequality, environmental degradation, and limited governance and service delivery capacity. The framework recognizes the need for local-level decision-making and spatial/territorial planning approaches at the city level for integrated actions to make progress on the SDGs, disaster risk reduction, low-carbon development, inclusive city planning and resilience-building.

The IUR framework provides a modular framework with a four-step decision-making process for UNDP, which combines conventional urban and territorial planning practices with scientific tools and approaches. The IUR provides core support services at different stages in the four-step decision support process for urban resilience, including raising awareness of resilience, establishing an urban resilience baseline, consultations and analysis to identify and prioritize risks, and developing urban resilience roadmaps. These services include
o   Introducing the concept of resilience planning,
o   Conducting baseline assessments,
o   Consultations with stakeholders,
o   Producing a resilience roadmap aligned with national commitments and development priorities. (UNDP, 2021)

The framework breaks away from the siloed approach and leverages the expertise of UNDP sectoral teams in the Asia Pacific Bangkok Regional Hub by involving them in a modular way to develop urban resiliency roadmaps. The figure shows the various UNDP experts utilized for the framework, showcasing an example of an integrated planning process. The framework stresses that establishing a risk management system requires an architecture that identifies roles and responsibilities, resources, modes of deploying resources and monitoring systems.
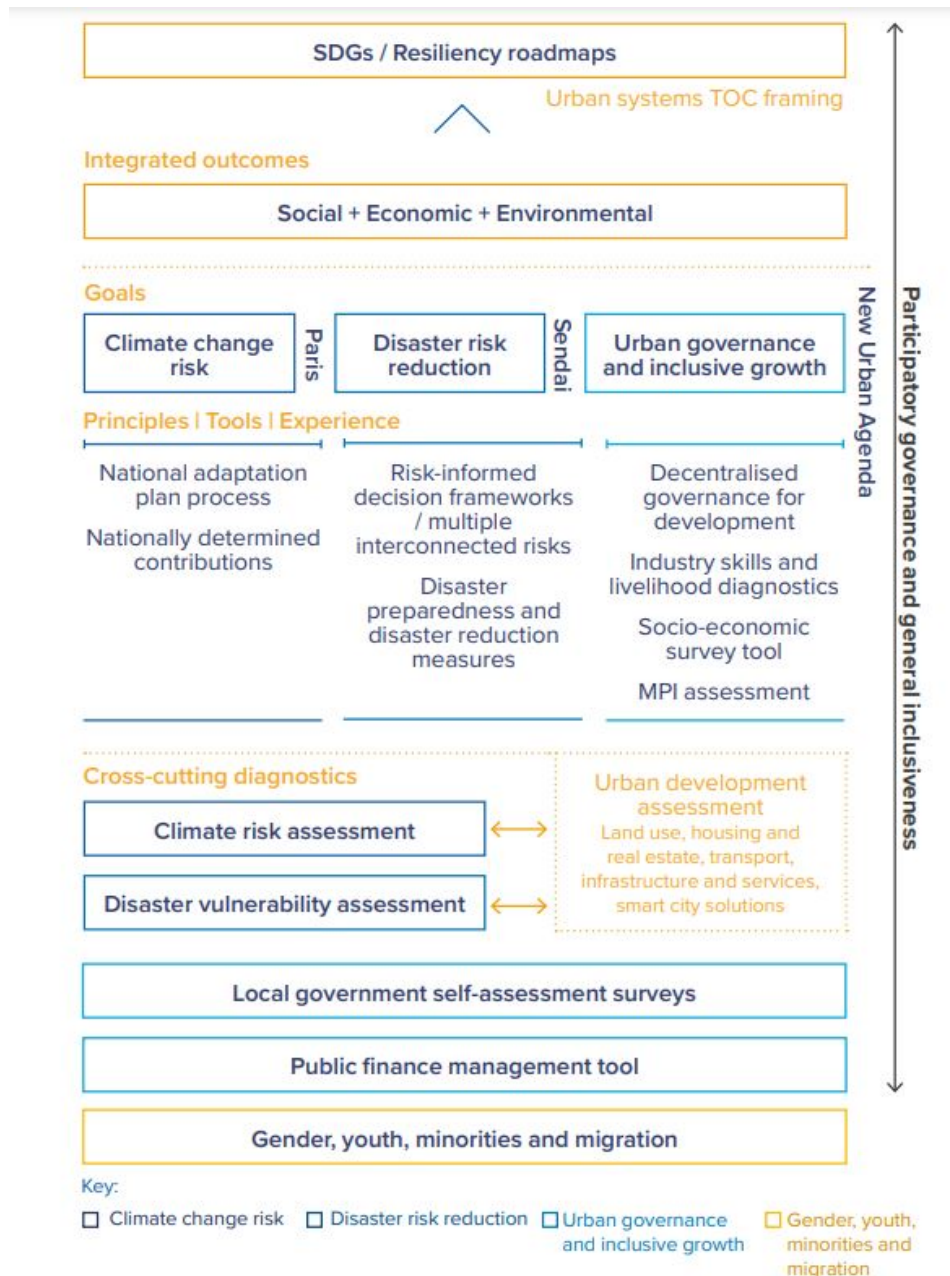
*Fig 3. Illustration of the Integrated Planning Process (UNDP, 2021)*

## Key frameworks and initiatives in India

- **Indian Smart Cities Mission (2015)**

India's Smart City Mission, launched in 2015 by the Ministry of Housing and Urban Affairs, aims to create sustainable and inclusive cities that provide core infrastructure, promote decent quality of life, and ensure a clean and sustainable environment through the application of smart solutions such as data-driven traffic management, intelligent lighting systems, and more (IBEF, 2021). The mission covers 100 cities and has a focus on compact areas and replicable models. The financing for the initiative comes from central sponsorship and requires contributions from state governments and urban local bodies. The mission follows an area-based development strategy that includes retrofitting, redevelopment, and Greenfield development, along with a pan-city initiative. The mission also seeks convergence with other government schemes and has received support from leading economies worldwide, including Spain, the US, Germany, Japan, France, Singapore, and Sweden. (ibid.)

The mission covers a range of sectors, including urban planning, governance, and infrastructure. Key indicators include the use of technology, citizen participation, and sustainability. Among them one of the criteria that can be used to evaluate the Smart City Projects of States/UTs is the impact of the proposal on the environment and resilience from disasters. The mission has been implemented in cities across India, including Delhi, and Ahmedabad.

The smart city framework proposed for India (NASSCOM, 2015) addresses the unique challenges faced by Indian cities and covers physical, social, environmental, and institutional infrastructure requirements. The framework aims to provide cost-efficient and intelligent physical infrastructure such as electricity supply, transport and traffic infrastructure, water supply system, sanitation facilities, healthcare, education, safety, cultural requirements, and establishments for citizen services required by the city. It also emphasizes the need for sustainability, environment-friendliness, and governance mechanisms to ensure the proper functioning of all other systems and processes. The smart city framework for India covers the following:

**Physical infrastructure** includes layers of energy, water, waste, mobility, and real estate, and aims to provide cost-efficient and intelligent infrastructure for things like electricity supply, transport, and sanitation.

**Social infrastructure** includes healthcare, education, safety, cultural requirements, and establishments for citizen services, and aims to provide intelligent and better-connected infrastructure for these needs.

**Environment-friendly infrastructure** is necessary for smart cities, with systems and processes in place to address climate change, pollution, disaster management, and city-specific issues.

**Governance mechanisms** are essential to ensure the proper functioning of all other systems and processes, including policies and regulatory mechanisms and an urban local body to execute processes (ibid.).
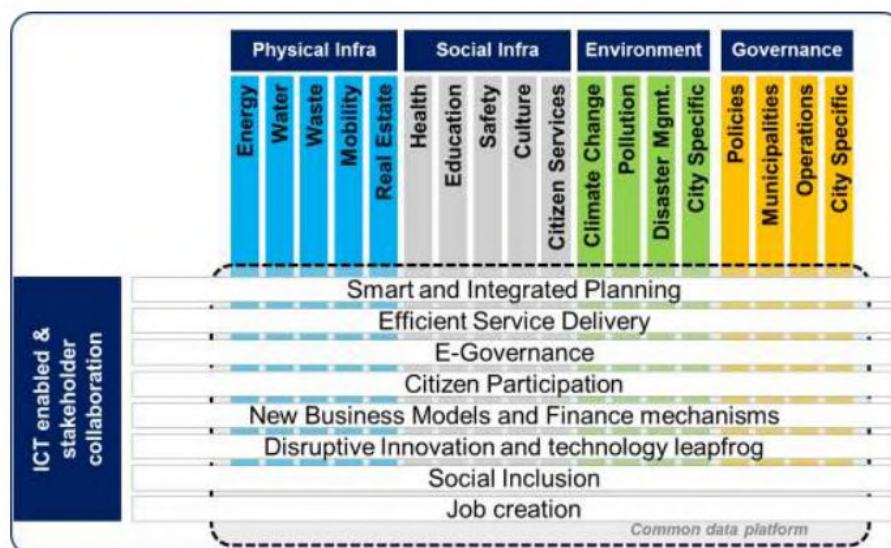


*Fig 4. Smart City Framework (NASSCOM, 2015)*

## Case Study: Surat Resilient City Strategy Framework, 2019

**Background**

Surat has a rich historical background and serves as an important trade center between India and the Gulf countries. Surat experiences a tropical monsoon climate with a high range of tidal activity due to

its location near the Gulf of Khambhat. The city has good connectivity in terms of roads, railways, and air transport, connecting it to major towns and cities of India. Surat has experienced rapid growth in the past four decades, making it the eighth-largest city in the country. However, with this growth comes the risk of both sea-level rise and flooding, which have been a challenge for the city in recent years.

The mission of the Surat Resilience Strategy is to become a Resilience Champion city by using innovative solutions to turn its challenges into opportunities and engaging citizens in the development of a cohesive, robust, and sustainable city. The city invites collaboration from all allies to achieve this goal.

### Strategy of Surat for Urban Resilience

As a part of Rockefeller's 100 Resilient Cities initiative, the city of Surat had developed a strategy document to improve the resilience of the city. Surat's resilience strategy framework consists of 7 pillars, 20 goals, and 63 initiatives. The seven pillars are Connectivity and Mobility, Affordable Housing, Water Availability and Quality, Employment and Economic Dependency, Environment and Ecosystem, Social Cohesion, and Public Health. The document prioritizes 11 initiatives for Connectivity and Mobility, seven initiatives for Affordable Housing, and thirteen initiatives for Water Availability and Quality, five initiatives for Employment and Economic Dependency, fourteen initiatives for Environment and Ecosystem, ten initiatives for Social Cohesion, and three initiatives for Public Health. The initiatives are interconnected and have a positive impact on other pillars.

For example, A key initiative would be the Multi-hazard risk assessment and mapping. The initiative is owned by the Surat Climate Change Trust, with support from various organizations. Surat is vulnerable to various hydrological and meteorological hazards such as floods and storm surges due to its location on reclaimed land in the sea and major industrial activities. The city plans to regularly analyze vulnerability and risks using GIS-based spatial analysis to monitor climate change impacts and integrate them with multi-hazard risk planning. The city will also enhance its existing Early Warning System to prepare for future resilience and can link it with a high-end Emergency Operation Center and mapping of new growth areas. This will support the improvement of other pillars such as public health, as it can reduce the lives lost or impacted as a result of it. Similarly, it can also support efficient transportation.

The city is considered a model city for urban resilience and has been able to address key challenges as a result of an incumbent strategy.

Key learnings from the Surat case

The framework considers the interventions in sectors integral to the city's functioning that has utilized the expertise of stakeholders in shaping the resilience strategy with innovative initiatives. Although the city is prone to floods, all-hazard impacts were taken into consideration while developing the interventions. These included the resilience of key infrastructure to public awareness and more.

*Fig 5. Surat Resilience Strategy Framework, 2017 (SMC, 2017)*

**Session Plan**

| Content | Trainer's Note | Time |
|---------|----------------|------|
| Frameworks | Focus on explaining the frameworks, the key themes and focal areas of the frameworks, the indicators, and so on | 40 min |
| Case Study | Focus on explaining the overview, the key framework, the pillars, and the interdependent nature of each initiative | 10 min |
| Discussion | Promote a discussion asking them to list down the key themes, and indicators that make urban areas resilient | 10 min |

**References**
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- OECD. (2023). Resilient Cities. https://www.oecd.org/cfe/resilient-cities.htm#:~:text=Resilient cities are cities that, cities can increase their resilience.
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- The Rockefeller Foundation. (2015). City Resilience Framework. https://www.rockefellerfoundation.org/report/city-resilience-framework/
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- UNDRR. (2010). The Ten Essentials for Making Cities Resilient. How to Make Cities More Resilient A Handbook for Local Government Leaders. https://www.unisdr.org/campaign/resilientcities/toolkit/article/the-ten-essentials-for-making-cities-resilient.html
- UNISDR. (2012). How to Make Cities More Resilient: A Handbook for Local Government Leaders.

**Additional Reading Material**
- Reducing Disaster Risk by Managing Urban Land Use https://www.adb.org/sites/default/files/publication/185415/disaster-risk-urban-land.pdf
- City Resilience Profiling Programme: Infrastructure Improvement Enhancer https://unhabitat.org/sites/default/files/download-manager-files/Infrastructure-Improvement-Enhancer-Small-Pages-2.pdf

# Notes

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# Learning Unit 3.3: Tools of Resilience Analysis/Assessment

**Brief Description of the Learning Unit**

This learning unit explains how different institutions have developed different tools that can act as highly effective techniques and spatially realized knowledge and decision base for ongoing improvement and decision making. It shows how local data availability and available expertise are integral to these tools that support building governance capacity in India and globally. Sendai Framework highlights the outcomes of good planning for DRR which can be supported by robust analysis and assessment. An understanding of these tools will support the learners to use them in their field of work in the future.

**Learning Objectives**

- To get a brief understanding of globally accepted resilience assessment tools for learners
- To understand the relevance in the Gujarat context through an exercise

**Duration:** 60 minutes

**Methodology**

- Lecture-based learning
- Exercise

**Detailed Description**

Building urban resilience requires a good understanding of the social, infrastructural, institutional, economic and environmental conditions of an area and the expertise of all stakeholders. Available tools for resilience assessment envision to support in building the resilience of a city. To develop a good understanding of urban resilience it is essential to understand what constitutes disaster risk and capacities; the process of evaluating disaster risk and aspects that will enhance resilience; and, how the results of the assessment can be used in the context of urban land use management. The impacts of hazard events can change from year to year depending on the timing, magnitude, intensity, and location of hazard events, especially with respect to population.

Hazards and their associated consequences can cause changes in the landscape and thus, affect land use and human activities and land use changes can lead to the creation of new risks. For example, hazards like floods affect the land use pattern in an area. Similarly, an increase in urban development in floodplains increases the chance of losses due to flooding. This makes the urban risk assessment essential before any development activity.

Therefore, it is important to examine those impacts over the long term to determine whether trends may be identified. Many established tools guide to assessment of urban resilience out of which few are– the disaster resilience scorecard, city resilience profiling tool, and Climate Disaster Resilience Index (CDRI) based on the dimensions of physical, social, economic, natural, and institutional resilience.

**Disaster resilience scorecard**

Designed around the Ten Essentials of Making Cities Resilient, the Disaster Resilience Scorecard has a set of assessments that local governments use to monitor and review progress and challenges in the implementation of the Sendai Framework for Disaster Risk Reduction: 2015-2030. The scorecard was designed for:

- Assisting countries and local governments in monitoring and reviewing progress and challenges in the implementation of the Sendai Framework.
- Enabling the development of a local disaster risk reduction strategy (resilience action plans)
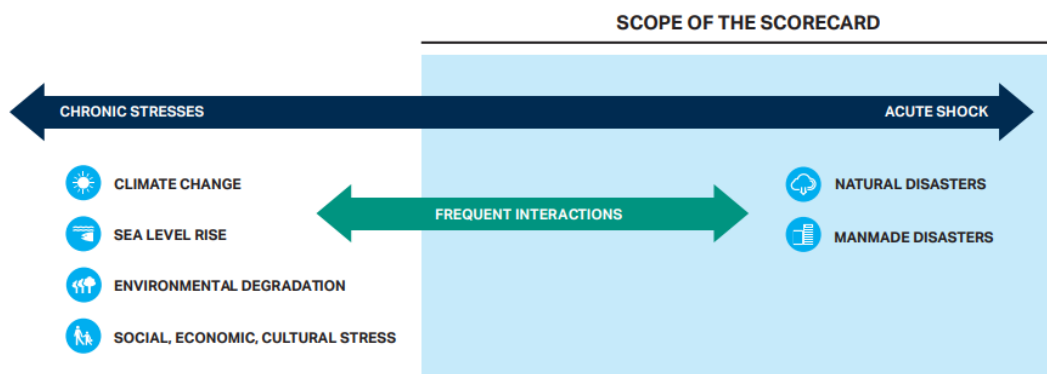
*Fig 1. Scope of Disaster Resilience Scorecard (UNDRR, 2017)*

The present scorecard is useful through two levels of score generation

**Level 1:** Preliminary level, responding to key Sendai Framework targets and indicators, and with some critical sub-questions. This approach is suggested for use in a 1 or 2-day city multi-stakeholder workshop. In total there are 47 questions/indicators, each with a 0 – 3 score;

**Level 2:** Detailed assessment. This approach is a multi-stakeholder exercise that may take 1 – 4 months and can be a basis for a detailed city resilience action plan. The detailed assessment includes 117 indicator criteria, each with a score of 0 – 5.

The scorecard prompts the users to identify the "most probable" and "most severe" risk scenarios for each of the identified city hazards or for a potential multi-hazard event. Some cities will have clear critical hazards, but for others, it may be less obvious, and the major risk may lie in a combination of otherwise subcritical events or the compounding effect of the events. Greater Manchester and Stoke on Trent, UK; Amadora, Portugal; Jonkoping and Arvika, Sweden are a few cities that have piloted the tool.
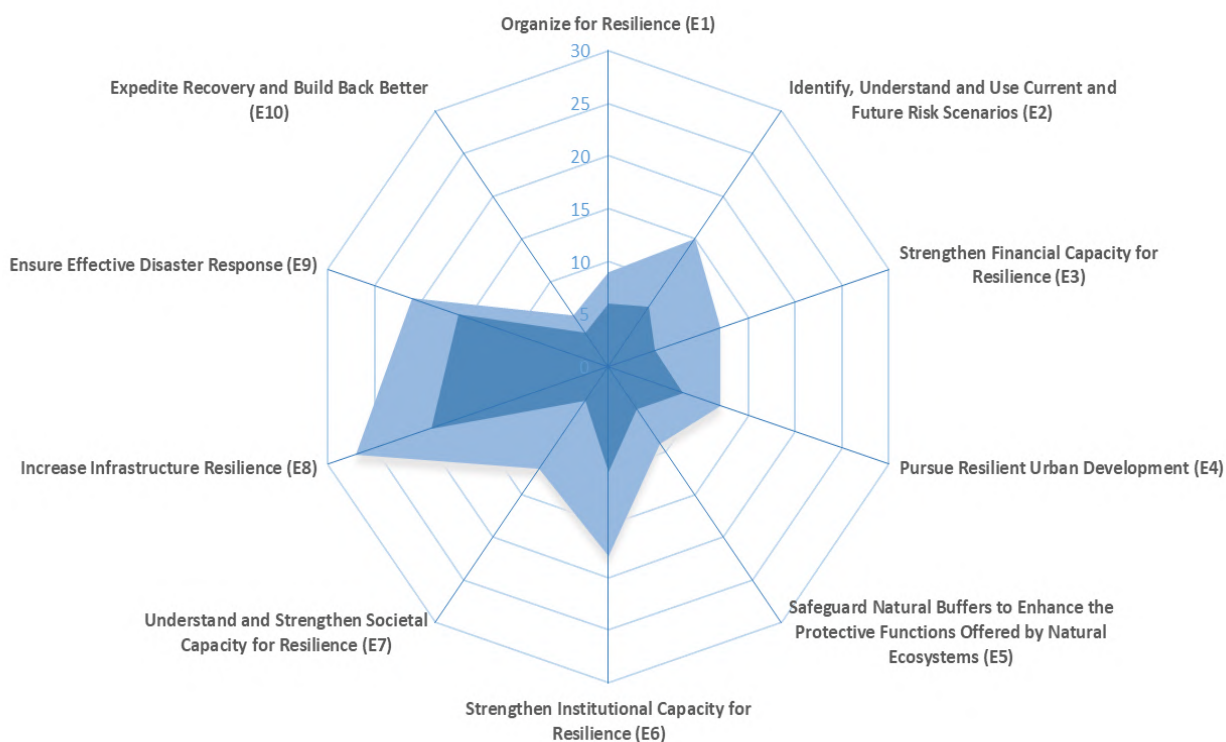


*Fig 2. Sample Result of the Scorecard (UNaLab)*

**City Resilience Profiling Tool (CRPT)**

Developed by UN-Habitat under the City Resilience Profiling Programme (CRPP) 2013, CRPT

supports the preliminary identification of gaps and opportunities over a series of different aspects regarding the city's structure and functionality. The tool functions with a 3-4 day training of city officials followed by gathering the relevant data and ensuring its traceability where the data collection is done in 4 sets: city's development narrative through its historical background and its spatial context, analysis of governance processes, internal and external shocks, stresses and challenges and followed by urban system and its performance.

Actions for Resilience (A4R) is integral to the tool as this step provides a roadmap for local governments to initiate change through actions based on evidence about stresses, shocks, challenges, and long-standing issues and problems.

The instructor could show the learners the following video for a better understanding of the tool:

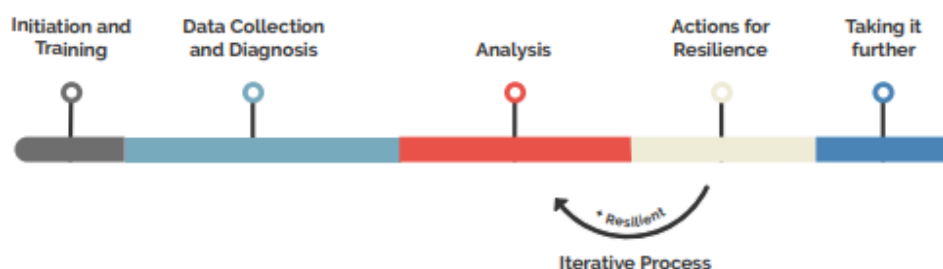Video: City Resilience Profiling with UN-Habitat by Urban Resilience Hub by UN-Habitat
**https://www.youtube.com/watch?v=BsacBJpbIPQ&t=93s**



*Fig 3. CRPT Implementation Process (UN-Habitat, 2016)*

## Climate Disaster Resilience Index (CDRI)

CDRI was developed to assess the existing level of climate disaster resilience. It considers five dimensions namely: physical, social, economic, institutional and natural as elaborated in Fig. Each dimension has five parameters and each parameter in turn has five variables. Therefore, the CDRI questionnaire has 125 questions. Respondents are required to assign weights to the variables and parameters to reflect the priorities of the cities and the relevance of the indicators to the local situation. Using data collected from the questionnaire surveys, Weighted Mean Index (WMI) method and Aggregate Weighted Mean Index (AWMI) are calculated to derive the scores for each parameter and dimension, respectively. Periodic monitoring can support the better use of the CDRI tool.
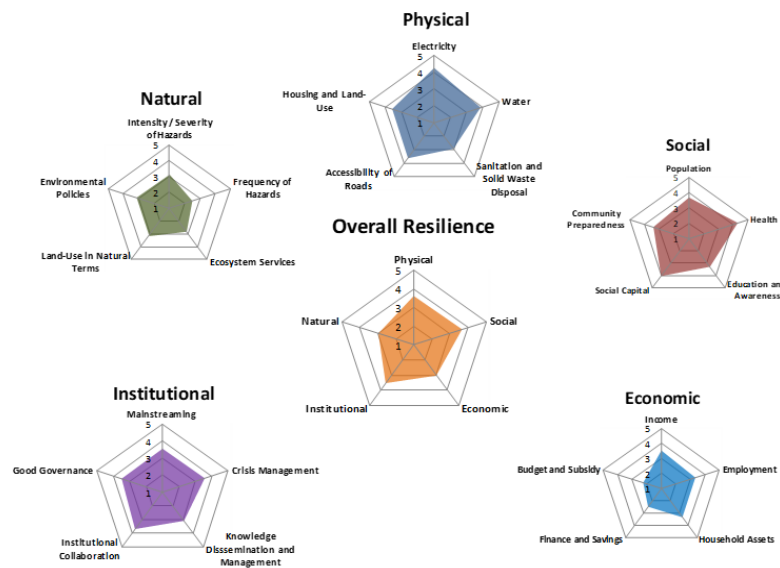


*Fig 4. Dimensions of CDRI*

*Fig 5. Sample Result of CDRI Tool Analysis*

The tools for urban resilience assessment have been accepted and used in assessing existing conditions and developing actions for the future of the cities. Some integral differentiating characteristics of each tool are the usability and indicators under consideration.

Disaster Resilience Scorecard for cities provides assessments that will allow local governments to monitor and review progress and challenges in the implementation of the Sendai Framework for

Disaster Risk Reduction: 2015-2030, and assess their disaster resilience in two levels. It has been adopted in more than 2000 cities.

City Resilience Profiling Tool (CRPT) is a self-assessment tool used by city managers that establish baselines (or 'profiles') addressed to municipal leaders, managers, urban planners, and other personnel with a responsibility for ensuring the maintenance, security, and functions of an urban area.

Climate Disaster Resilience Index is a tool to evaluate the resilience capacities based on qualitative information of the city. It can be used in consultation with local stakeholders and assigns dimensional scores that indicate the need for change or improvements.

**Group Exercise**

Evaluating resilience requires being aware of what is going on at multiple scales (local, city, national) and acting accordingly. For this, learners will identify current resilience-building interventions related to the priority shocks and risks in the given area.
- Create a scale vs. risks chart on the whiteboard while dividing learners into groups
- Participants write down projects, actions, and policies that are currently being implemented
- When challenges come in enlisting, they should discuss how they could find out who would have information about it
- Engage in discussion on: Are the vulnerable communities identified before these interventions? Where can grassroots-level efforts better support city-level resilience?

**Activity template**

**National**

**State**

**City**

**Local**

**Major Risk 1    Proj. Actions    Major Risk 2    Proj. Actions    Major Risk 3    Proj. Actions**

**Department, agency with information**

**Areas of better support in city**

**Session Plan**

| Content | Trainer's Note | Time |
|---------|----------------|------|
| Tools | Focus on explaining the three tool available for urban resilience and their key components | 20 min |
| Exercise | Focus on understanding the resilience of their city with the understanding of existing conditions | 40 min |

**References**
- City Resilience Profiling Tool
  https://urbanresiliencehub.org/wp-content/uploads/2018/02/CRPT-Guide.pdf
- Disaster                               resilience                               scorecard
  https://www.unisdr.org/campaign/resilientcities/assets/toolkit/Scorecard/UNDRR_Disaster%20re
  silience%20%20scorecard%20for%20cities_Detailed_English.pdf
- CDRI                                                                                                    tool
  https://unfccc.int/files/adaptation/knowledge_resources/databases/partners_action_pledges/applic
  ation/pdf/kyotouni_furtherinfo_100519.pdf
- M. Francis and M.R.Z. Whitworth (2016) Lifeline Infrastructure and the UN disaster resilience scorecard

**Additional Reading Material**
- Measuring   Disaster   Risks   and   Resilience   at   Sub-National   Level   in   India.
  https://www.preventionweb.net/files/65901_measuringdisasterrisksandresilience.pdf

# Notes

# Learning Unit 3.4: Group Exercise on Resilience Tool

**Brief Description of the Learning Unit**

This learning unit supports stakeholders working in cities that want to work on resilience, and organizations and find challenges that need to be addressed related to resilience in theory and practice and address issues of complexity, urbanization, and development.

**Learning Objectives**

- To analyze risk and identify resilience opportunities at the city-scale
- To build a group of stakeholders that work together toward common risk reduction and resilience-building goals.

**Duration**: 60 mins

**Methodology**

- Discussion and activity

**Detailed Description**

Engage participants to discuss:

What is changing in their city and the actions could be started now that would help to deal with both current and possible future challenges?

Engage the learners to fill the matrix on the flipchart with information on their perception of what life was like within each of the 5 dimensions of CDRI like access to facilities, low development in hazardous areas, etc. Based on the risks and conditions now what would be the future condition, what new risks would emerge etc? Each parameter would be scored from 1 to 5 where 1 means low resilience and 5 means high resilience. For the ease of this activity, the resilience score of each dimension is derived as the average score of 5 parameter score:

| Dimensions | Past (20 years ago) | | Now | | Future | |
|---|---|---|---|---|---|---|
| | Risks | Resilience score | Risks | Resilience score | Risks | Resilience score |
| **Physical** | | | | | | |
| • Electricity (coverage, emergency options, etc.) | | | | | | |
| • Water (quality, coverage, emergency options, duration, etc.) | | | | | | |
| • Sanitation and solid waste disposal (collection time, segregation etc.) | | | | | | |

| Dimensions | Past (20 years ago) | | Now | | Future | |
|---|---|---|---|---|---|---|
| | Risks | Resilience score | Risks | Resilience score | Risks | Resilience score |
| • Accessibility of road (condition, width etc.) | | | | | | |
| • Housing and land use (permanent vs non-permanent, codes etc.) | | | | | | |
| **Social** | | | | | | |
| • Population (growth, density, slum population %, etc.) | | | | | | |
| • Health (access to primary healthcare, vector, waterborne disease, etc.) | | | | | | |
| • Education and awareness (DRM knowledge, literacy rate, etc.) | | | | | | |
| • Social capital (cohesion, community participation in decisions, etc.) | | | | | | |
| • Community preparedness (extent of preparedness, voluntary evacuation, etc.) | | | | | | |
| **Economic** | | | | | | |
| • Income (BPL %, informal sector, impact from disaster %, etc.) | | | | | | |

| Dimensions | Past (20 years ago) | | Now | | Future | |
|---|---|---|---|---|---|---|
| | Risks | Resilience score | Risks | Resilience score | Risks | Resilience score |
| • Employment (formal sector, child labor, etc.) | | | | | | |
| • Household assets (% with vehicle, mobiles, etc.) | | | | | | |
| • Finance and savings (credit facility, insurance schemes) | | | | | | |
| • Budget and subsidy (funds for DRM, subsidies for affected, etc.) | | | | | | |
| **Institutional** | | | | | | |
| • Mainstreaming of disaster risk reduction (DPR) and Climate Change Adaptation (CCA) | | | | | | |
| • Effectiveness of city's crisis management framework | | | | | | |
| • Knowledge dissemination and management | | | | | | |
| • Institutional Collaboration with other organisations and stakeholders | | | | | | |
| • Good Governance (effectiveness of | | | | | | |

| Dimensions | Past (20 years ago) | | Now | | Future | |
|---|---|---|---|---|---|---|
| | Risks | Resilience score | Risks | Resilience score | Risks | Resilience score |
| EWS, transparency) | | | | | | |
| **Natural** | | | | | | |
| • Intensity of key hazard | | | | | | |
| • Frequency of key hazard | | | | | | |
| • Ecosystem service (air, soil, water quality) | | | | | | |
| • Landuse in natural terms (hazardous site proximity, built-up vs green areas) | | | | | | |
| • Environmental policies | | | | | | |

# Notes

## Summary

The Technical Session 3 guides the learners on:

- Details of different frameworks for urban resilience like City Resilience Framework, New Urban Agenda, Making Cities Resilient, and their key considerations
- Smart Cities Mission and Surat Resilience Strategy and other prevalent instruments encouraging urban resilience
- Interdependence of the initiatives for enhancing resilience and development of urban areas
- Existing tools like resilience scorecard, CDRI, etc. globally and nationally are commonly used to evaluate resilience
- Identification of the challenges in a city and goals for developing resilience strategies

# Technical Session 4: Good Practices in Building Resilient, Safe Towns and Cities

## Introduction, Overview & Perspectives

The fourth technical session, Good Practices in Building Resilient Towns and Cities, will look at successful case studies and associated good practices and lessons learned in building resilient towns and cities. The session is intended to provide learners with practical tools and strategies for improving their own cities' resilience.

- Learning Unit 4.1: Case Studies on building resilient towns and Cities
- Learning Unit 4.2: Sectoral experience sharing on similar initiatives

The objective of the session is to
- To highlight successful community-based initiatives, innovative technologies, and nature-based solutions for building resilient and safe cities, as well as to provide learners with practical tools and strategies for their work.
- To encourage learners to learn from each other's successes and challenges in building resilient towns and cities by facilitating sectoral experience sharing.
- To motivate learners to take action in their respective communities or cities

**Duration**: 120 minutes

## Methodology
- Lecture-based Learning
- Group activity
- Discussion

## Trainer's Note
The trainer for the fourth technical session on "Good Practices in Building Resilient Towns and Cities" should aim to provide learners with practical tools and strategies for improving their own cities' resilience and safety. This can be achieved by showcasing successful case studies and good practices in building resilient and safe cities, with a focus on community-based initiatives, the use of innovation and technologies, nature-based solutions, and critical infrastructure resilience.

During the session, the trainer should encourage sectoral experience sharing among the learners, allowing them to gain insights from each other's experiences and practices. The trainer should also facilitate interactive discussions and exercises that encourage critical thinking and problem-solving skills and foster a sense of teamwork and collaboration among the learners. Overall, the trainer should create an engaging and interactive learning environment that encourages active participation and knowledge sharing among the learners.

**Brief Description of the Leaning Unit**

The learning unit "Case studies on building resilient towns and cities" focuses on exploring various thematic approaches and strategies for enhancing urban resilience. The unit includes cases on community-based initiatives, the use of innovation and technologies, nature-based solutions, and critical infrastructure resilience. It highlights the importance of community participation and engagement, the use of innovative technologies, and nature-based solutions in building resilient cities. The learning unit also emphasizes the significance of critical infrastructure resilience in mitigating the impacts of disasters and ensuring the continuity of essential services. Through case studies and good practices, learners will gain insights into the practical implementation of these approaches and strategies and understand how they can be adapted to specific urban contexts.

**Learning Objectives**

- To know about the recent practices that promote urban resilience globally.
- To analyze varied case studies and to capture the key lessons and challenges

**Duration:** 60 min

**Methodology**

- Lecture-based learning
- Q & A
- Discussion

**Detailed Description**

Resilient cities are planned and constructed to resist and adapt to the effects of climate change as well as other shocks and pressures including natural hazards, economic disruptions, and social conflict (OECD, 2023; UNISDR, 2012). In light of the growing hazards and uncertainties brought on by climate change, the idea of resilient cities has become an essential part of urban planning and design. As the global climate continues to change, the need for resilient cities is increasing. Natural hazards like hurricanes, floods, and droughts are becoming more common and strong due to climate change, endangering the safety and well-being of urban populations. Furthermore, rising sea levels and other factors can have a negative impact on cities in many ways, including infrastructure damage, public health hazards, and disruptions to the economy. Therefore, there is a keen need to look for good practices

Building resilient towns and cities is a challenging endeavor that calls for the participation of many stakeholders, including local governments, community-based groups, corporate sector actors, and communities. While these practices are divided into various themes, it is critical to acknowledge that all these themes are interconnected. Initial intervention in one theme could result in significant improvement of other themes. The following good practices can help to improve the resilience of urban areas:

**a.Social:** Good practices targeting social dimension of resilience are policies, strategies, and actions that promote community well-being and social resilience (OECD, 2023). They are concerned with developing inclusive and equitable social systems that support the physical, economic, and environmental aspects of a community. Here are a few examples of such good practices that can be implemented to improve urban resilience:

- **Community Engagement:** Involving communities in the planning, decision-making, and

implementation processes is critical for building resilience. This helps to ensure that the needs and concerns of all community members are addressed, and it fosters a sense of ownership and accountability. The Tokyo Earthquake Resistant City project, where the community was involved in the planning and implementation of earthquake-resistant buildings is an example of community engagement.

In Gujarat, Bhuj was not covered under the Rajiv Awas Yojana in 2009, because it was a smaller town, "Homes in the City" programme was launched by a group of development agencies, NGOs, in partnership with Kutch Mahila Vikas Sangathan (KMVS), Sahjeevan, Arid Communities and Technology and Urban Setu. Bhuj Municipality supported some of its initiatives through funding. Kutch Mahila Vikas Sangathan which promoted women empowerment had helped form self-help groups in the slums and organized them into a network that had identified vulnerable households in the slums of Bhuj. The initial work through these agencies led local governments to take cognizance of proper housing needs in Bhuj and the Rajiv Awas Yojana scheme was extended in 2012 to include Bhuj.

Video: Homes In the City - Housing in Bhuj slums: **https://www.youtube.com/watch?v=FvBLG66YfLg**

- **Capacity Building:** Capacity building entails equipping communities with the knowledge, skills, and resources they need to prepare for, respond to, and recover from disasters. This includes disaster risk reduction, emergency response, and recovery planning training. The Odisha Disaster Mitigation Programme, which focused on the construction of cyclone shelters and training communities on their use and maintenance, first aid, search and rescue, health and hygiene, and financial management, is an example of capacity building. After the 2001 earthquake, GSDMA rolled out the training for masons so that the quality of construction in rural and semi-urban areas could be improved. These masons were certified by the Gujarat Council of Vocational Training.

Video: Why Odisha is a role model for disaster preparedness by United Nations Office for Disaster Risk Reduction: **https://www.youtube.com/watch?v=2ivFrzd0f6M**

**b. Infrastructural:** Good practices targeting the infrastructural dimension of resilience focus on designing and constructing buildings and infrastructure that are resilient to natural and anthropogenic hazards (UNISDR, 2012). Some key such good practices for urban resilience include:

- Improving design-based critical infrastructure resilience such as designing buildings with strong foundations and materials that can withstand earthquakes, floods, and other natural hazards. For example, Tokyo's earthquake-resistant building design standards, which include base isolation and other seismic isolation systems, as well as wind-resistant features for tall buildings is a classic example of investment in urban resilience (Global Economy, 2021).
- Incorporating green infrastructure, such as green roofs and permeable pavement, to manage stormwater and reduce flooding.
- Implementing measures to protect against extreme heat, such as planting trees and installing shading structures.
- Focus on utilizing technological innovation coupled with built practices such as sensor-based dam management systems

In Gujarat's Rajkot, with support from ICLEI Smart GHAR III (Green Homes at Affordable Rate) project on affordable housing under the Pradhan Mantri Awas Yojana (PMAY) Untenable Slum Redevelopment is being executed by the Rajkot Municipal Corporation (RMC). It includes features to improve the living conditions by reducing heat impacts on residents by minimizing heat gains through walls and roofs; improving window design; and improving ventilation through common service shaft.

Video: Energy Efficiency in the Indian City of Rajkot by ICLEI South Asia **https://www.youtube.com/watch?v=rluL3WYodi4**

**c. Environmental:** Good practices targeted at the environmental dimension of resilience are concerned with preserving and restoring natural systems and processes that contribute to urban resilience (OECD, 2023). To address the dynamic complexity of socio-ecological systems and to use nature to minimize damage and increase resilience nature-based solutions are finding prominence in urban settings. Some of the good practices for urban resilience are:

- Preserving and restoring natural habitats, such as wetlands and forests, which provide critical ecosystem services such as flood control and air purification
- Creating green spaces, such as parks and urban forests, in urban areas to help regulate temperature, improve air quality, and provide recreational opportunities.
- Promoting environmentally sustainable land use practices, such as limiting urban sprawl and protecting agricultural land from development.

An example would be the Cheonggyecheon Stream Restoration Project in Seoul, which transformed an urban highway into a public park with a restored stream and wetlands, providing recreational opportunities and improving the area's ecological resilience.



*Fig 1. Before and After of Cheonggyecheon Stream Restoration Project (Source: WWF)*

Booklet on Nature-Based Solutions for Disaster Risk Management by World Bank

**d. Economic:** Good practices targeting the economic dimension of resilience focus on promoting economic development that is sustainable, equitable, and resilient to shocks and stresses (OECD, 2023). Some key good practices in this regard include:

- Supporting small and medium-sized businesses, which are often more prone to economic shocks than larger corporations. E.g. The city of Nashik is vulnerable to various kinds of hazards like floods, earthquakes, etc. The district administration felt the need of preparing an emergency response plan to minimize the negative impacts of a natural calamity and brought new reforms in 2019. An integrated disaster management plan for the city along with a compensatory amount of Rs. 75,000/- for small businesses that suffered damages during the flood disaster was undertaken.

- Promoting sustainable tourism and other industries that support local economies without putting excessive strain on natural resources or cultural heritage. Eg. The Gujarat Tourism Policy 2021-2025 encourages and incentivizes the adoption of E-Vehicles by tourism service providers, projects with green building or sustainability certification, and the establishment of E-Vehicle charging stations.

**e. Institutional:** Practices that focus on coordination and management through establishing dedicated city-level specialized committees and local-level strategies to align with national and state-level plans are integral to the institutional dimension.

The Government of India, in collaboration with international agencies, has been promoting and providing risk insurance to vulnerable populations, providing a platform to showcase their work and handholding for low-income households and small businesses, to reduce the impact of disasters. This is also significant as when cities invest in their local economies; they create jobs and support small businesses, which can contribute to greater economic stability and resilience as shown by **Startup India Mission, 2014**.

**PMAY Mission** also supports improving institutional resilience along with the housing needs of the urban poor using credit-linked subsidies and development of housing in the PPP model and subsidies for beneficiary-led individual houses. The technology sub-mission incorporates green technologies and deploys disaster-resistant building technologies.

**AMRUT** focuses on improving water supply, sewerage, storm water drains, etc. It involves ULBs preparing a Service Level Implementation Plan (SLIP) that is crucial for improving the resilience of the vulnerable and the poor population

Let us look at some real-world case studies in detail that showcase the success of interventions/ practices in building resilient and safe cities.

1. **Rotterdam City Water Square Project**
Rotterdam is the Netherlands' second-largest city. The Dutch city is a pioneer in the use of new engineering techniques to increase resilience and get ready for climate change. Due to its location near the mouth of the Rhine River, the city, which is home to over 2.7 million people (Fumero, 2020), is one of the most flood-prone regions in all of Europe. In response, the city has implemented a variety of cutting-edge structures and technologies to increase its resilience. The key driver behind Rotterdam's emphasis on technology is the realization that conventional flood management strategies like levees and dams might not be adequate to address the scope of the threats it faces (EUCOLD Working Group, 2018). The city has therefore adopted a more holistic approach, which includes the use of technology to enhance its capacity to monitor, predict, and respond to flood events.

**Water Square Technology:** The key design concept that Rotterdam has used to build resilience is the Water Square Concept, which was developed in response to the city's frequent flooding (Ilgen et al., 2019). Water squares are public spaces that are designed to serve multiple functions, including as a

recreational area, a gathering space, and most importantly, as a solution for managing stormwater. It is useful for densely built-up urban areas, where it is often difficult to get rainwater retention. These systems are linked to other urban functions such as playing areas, green areas and residential functions. During periods of heavy rain, the water square fills with water, which is then slowly released into the city's drainage system.

The squares feature lower-lying areas that can be submerged in the case of heavy rainfall. The run-off from the surrounding district is connected to the square by open drains or rainwater drainage systems. This helps to prevent flooding in other areas of the city and reduces pressure on the city's sewer system.
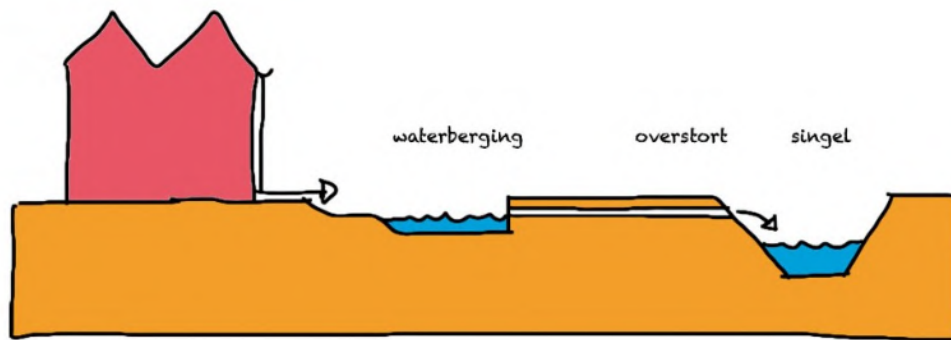


*Fig 2. Section scheme of a water square (atelier GROENBLAUW)*

**Mission and Approach:** The mission of Rotterdam's resilience-building initiatives is to make the city more resilient to threats including urbanization, climate change, and other hazards (Fumero, 2020). The city's resilience strategy is based on three frameworks: the City Resilience Framework, the 100 Resilient Cities Framework, and the United Nations' Sustainable Development Goals. These frameworks help the city to identify key resilience challenges, set priorities, and monitor progress towards its resilience goals.

Rotterdam has adopted a comprehensive resilience framework for the 2030 vision for Rotterdam Water City (Fumero, 2020), which is focused on the following four main objectives:

- Protection: Prevent flooding inside and outside the dykes to spare Rotterdam
- Clean Water: Assuring water quality in accordance with the European Water Framework Directive will enhance city amenities.
- Attractive City: To tackle water issues and improve the city's appeal as a location to live, work, and unwind, integrate urban planning with water management.
- Sewers: Use decentralized, creative methods that are specifically tailored to the area to reorganize stormwater runoff (ibid.)

This involved various activities such as improving the city's physical infrastructure, such as its structures, roadways, and water management systems, to increase its ability to withstand shocks and pressures and recover from them, promoting sustainable behaviors, safeguarding natural resources, and reducing the effects of climate change to increase environmental resilience.

A well-known example of a water square is the Benthemplein Water Square in Rotterdam (Fumero, 2020; Ilgen et al., 2019). The Benthemplein neighborhood, where the water square is situated, is a densely populated area that is vulnerable to flooding because of its low-lying geography and abundance of impervious surfaces.

The design phase of the Water Square can be divided into two. The installation of an underground storage facility with a capacity of 10,000 cubic metres of water marked the start of the first phase of the Benthemplein Water Square project in 2008 (Ilgen et al., 2019). The second phase, which was finished in 2013, involves building the actual water square. The square features a series of sunken basins and shallow channels that are used to store the excess water. Once the storm has passed, the

water is slowly released back into the surrounding environment, creating a visually appealing and functional public space. The risk of flooding in the area is then decreased by gradually releasing the water back into the neighboring soil or waterways. Since that time, the water square has been successfully controlling rainwater during periods of high rainfall while also offering a useful public space for the neighborhood.  The square covers an area of around 1,400 square meters and is capable of holding up to 2 million liters (528,344 gallons) of water (Stormwater Magazine, 2023).

The square has been designed to blend in with the surrounding urban environment and includes features such as benches, trees, and a play area for children. The square is designed to be multifunctional and can be used as a public space during dry weather conditions. During heavy rain, the square's central basin fills with water, and the water is slowly released into the surrounding soil and drainage system over several hours. This allows the water to be naturally filtered and helps to reduce the risk of flooding in the surrounding area.



*Fig 3. Benthemplein water square*

The Benthemplein water square is just one example of the water square concept, which has been implemented in several cities around the world, including Tokyo, New York, and Rotterdam. A concept is a promising approach to urban stormwater management, as it provides an innovative solution to flooding and water management that is both functional and visually appealing.


2.  **JAGA Mission Odisha**

The Ministry of Housing and Urban Affairs (MoHUA), Government of India has developed and implemented several schemes and policies over the years for housing and basic services like the Basic Services for the Urban Poor (2005), Rajiv Awas Yojana (2011) the Integrated Housing and Slum Development Programme (2005), the National Urban Housing and Habitat Policy (2007). Along similar lines, the Odisha government has initiated the JAGA mission, which aims to provide land rights and other basic facilities like housing, drinking water, LED lights, and toilets to the urban poor. This was initiated after the historic legislation "Odisha Land Rights to Slum Dwellers Act, 2017" was enacted on 16th October 2017. The JAGA Mission intents to provide liveable habitats for poor people in urban settlements. Under this scheme, slum-level Slum Dwellers Associations (SDA) were formed across the cities to assist in the slum up gradation and community mobilization.

**Mission and Approach:** The award-winning Mission "JAGA" has been gaining ground with time and

being applauded internationally for its 'smooth implementation across the state of Odisha. It is unique in its acknowledgment of residents as city makers. Odisha faces disasters every year and the population is pushed into poverty due to the damages. However, with the unique model of JAGA Mission, the narrative took a shift, from slum-dwellers being encroachers to being upraised with the recognition to bring in their skills. The Mission has adopted to developing five cities as Living Labs where the process of progressing from slum upgrading to preventing slums from being created in the cities is being taken up.

**Practices:** The JAGA Mission has implemented a range of practices, including the formation of community-level committees, technology, etc. A few of them worth noting are:

- Community Leadership: One of the main components of the programme is social mobilization, JAGA has created 2,931 slum collectives known as 'Slum Dwellers Associations' (SDA) to build and engage with communities. Each SDA requires 50 percent women's representation. This led to a fourth tier of governance by fixing leadership and participation gaps in urban informal communities. SDAs sign a memorandum of understanding with city governments to create, and maintain community assets and as equal partners of change. Upgrading work is only considered complete when the SDA gives written confirmation

- Universal Coverage: The mission has taken into consideration all 2,919 slums in all 114 cities and towns of the state allowing it to address vulnerabilities in slums in cities located in all types of hazard-prone zones of Odisha. It leverages the financial convergence of central state grants and provisions to make urban poor initiatives like PMAY effortless and seamless while enabling fiscal decentralisation and accountability.

- Technology for decision making: The Mission led to the creation of a high-resolution spatial database of all its slums with drone imagery from 2,077 slums was used to locate and define slum boundaries and was GIS-mapped. High cyclone damage risk zone containing 1,407 slums in 50 cities were identified and in them, the most vulnerable were among the first to get land rights. For these government subsidies are also made available to slum dwellers to construct new houses made of permanent materials.

- Dual mode of upgradation: The Mission functions in a way that slum dwellers can get in-situ development or relocation. The residents of slums located near waste dumpsites and floodplains can volunteer for relocation to more environmentally secure and healthier locations.

**Impact:** The Mission has had a significant impact in changing the perception of officials about the slum dwellers. This has led to drawing attention to the needs of marginalised groups, including women, transgender people, and those with disabilities, ensuring that those needs are integrated. SDA's knowledge of local environmental conditions is often used to adapt construction projects at the request of the community, a building that would normally have an open design was adapted to have a walled structure so it could also be used as a cyclone shelter. It has led to an assurance of the safety of life and property during disasters in Odisha. In conclusion, the JAGA Mission is an example of a successful community-led program that has the potential to address urban inequality and vulnerability to disasters and climate change, simultaneously.
More details: World Habitats Awards: https://world-habitat.org/world-habitat-awards/winners-and-finalists/jaga-mission/#award-content

Video: China's sponge cities by Interesting Engineering: **https://youtube.com/watch?v=8gLl50h8YWk&si=EnSIkaIECMiOmarE**

## Conclusion
Overall, these case studies demonstrate the importance of community-based initiatives, the use of

innovation and technologies, nature-based solutions, and critical infrastructure resilience in building resilient towns and cities.

**Session Plan**

| Content | Trainer's Note | Time |
|---|---|---|
| Introduction on Showcasing initiatives in all resilience dimensions | Focus on explaining key terminologies, the good practices, and explain briefly the examples cited | 30 min |
| Case Study 1 - Global | Focus on explaining the good practices in detail, focusing on design and the impact | 15 min |
| Case Study 2- India | Focus on promoting the knowledge of the overview, the key steps, and the impacts | 15 min |
| Additional Case Study 3 for learners' future use. | | |

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- UNISDR. (2012). How to Make Cities More Resilient: A Handbook for Local Government Leaders.

**Additional Reading Materials**

- Key Building Design and Construction Lessons from the 2023 Türkiye–Syria Earthquakes https://www.mdpi.com/2673-8945/3/1/7
- Best Practices Compendium ClimateSmart CITIES https://niua.in/csc/assets/pdf/key-documents/Best-Practices-Compendium-full-version.pdf

# Notes

# Learning Unit 4.2: Sectoral Experience Sharing on Similar Initiatives

**Brief Description of the Learning Unit**

The learning unit 'Sectoral experience sharing 'provides learners the opportunity to gain knowledge from the experiences of learners from different departments and local authorities that have planned and/or implemented resilience-building initiatives. The idea of the module is to promote cross-sectoral learning.

**Learning Objectives**

- To explore sectoral experiences and good practices related to building resilience in urban contexts
- To identify key success factors and challenges faced by different sectors in implementing resilience-building initiatives, and to understand how these can be addressed in future initiatives

**Duration:** 60 min

**Methodology**

- Discussion

**Detailed Description**

This is an illustrative example. Gujarat government has planned to promote a resilient riverfront city on the outskirts of a city with a population of 1 million, which is along the banks of a perennial river. The project involves formulating housing options, planning and designing of riverfront, infrastructure development including embankments, bridges, parks, gardens, and cycling tracks, implementation of commercial projects, development of public spaces, cultural centers, and institutions, and so on. The teams should be divided into the following

- Urban Planning and Design
- Infrastructure Development
- Environment and Ecology
- Housing and Commercial Development
- Social and Cultural Development

The team should discuss the below key phases, and note the key activities, their impacts, and key challenges which are sectoral & cross-sectoral, and then engage in a discussion, whereby they will generate a more favorable outcome for the project. The team should take up at least one novel technology, community engagement, and other key principles while analyzing the phases.

Key Phases of the Project
1. Baseline survey and data collection
2. Planning and design of the riverfront development project
3. Land acquisition and resettlement of affected communities
4. Infrastructure development including embankments, bridges, parks, gardens, and cycling tracks
5. Implementation of housing and commercial projects
6. Development of public spaces, cultural centres, and institutions

Focus on the three key tasks (Refer to the session plan for further details)
- Key activities and impacts per sector
- Challenges
- Key takeaways

**Session Plan**

| Content | Trainer's Note | Time |
|---|---|---|
| Introduction to the scenario | The trainer should focus on explaining the scenario to the learners and should ask them to list down the key activities and impacts per sector, as well as the key challenges (intersectional or intra). Also, ask the learners to involve innovative methods for decision making | 5 min |
| Discussion | The trainer should ask them to list down the activities on a whiteboard per team, which is visible to all. Focus on promoting a healthy discussion by involving everyone, and try solving each issue in a comprehensive manner | 20 min |
| Key takeaways | The trainer should focus on getting key takeaways from the learners as a part of the exercise | 5 min |

# Notes

## Summary

The Technical Session 4 guides the learners on:

- Details of successful global, national, and regional practices, community-based initiatives, innovative technologies, and nature-based solutions for building resilient and safe cities
- Sectoral experiences from ongoing projects and mutual learning on urban resilience practices

# Technical Session 5: Urban Resilience and Governance

## Introduction, Overview & Perspectives

The goal of the Technical Session on "Urban Resilience and Governance" is to inform learners on how to integrate disaster risk management and climate change adaptation into urban development planning. The session will also cover inter-departmental/multi-sectoral risk management as well as the development of institutional mechanisms for urban risk governance. A field trip is also organized to give learners hands-on experience with existing efforts on urban resilience and governance of the same.

The objectives of the session are as follows:
- To enhance the learner's understanding of the importance of mainstreaming disaster risk management and climate change adaptation into urban development planning
- To introduce learners to inter-departmental and multi-sectoral approaches to risk management
- To enable learners to draft institutional mechanisms for urban risk governance through a group exercise

The units covered in the technical session are:
- Learning Unit 5.1: Mainstreaming Disaster Risk Management and Climate Change Adaptation into Urban Development Planning
- Learning Unit 5.2: Inter-departmental/multi-sectoral risk management
- Learning Unit 5.3: Group Exercise – Drafting institutional mechanism for urban risk governance
- Learning Unit 5.4: Field Visit

**Duration**: 330 minutes

## Methodology
- Lecture-based Learning
- Group Exercise
- Field Visit

## Trainer's Note

As the trainer for this technical session on "Urban Resilience and Governance," it is important to focus on several key areas. Firstly, it is crucial to ensure that learners understand the importance of

mainstreaming disaster risk management and climate change adaptation into urban development planning. Secondly, learners should be introduced to the concept of inter-departmental/multi-sectoral risk management. This involves working collaboratively with other departments and organizations to identify and address risks in a coordinated manner. The trainer should emphasize the importance of effective communication and collaboration, and provide examples of successful multi-sectoral risk management initiatives. Finally, learners should be allowed to put their knowledge into practice by participating in a group exercise to draft an institutional mechanism for urban risk governance. This exercise should be designed to encourage critical thinking and problem-solving skills and provide learners with a real-world understanding of the challenges and opportunities involved in urban risk governance.

Overall, the trainer should aim to create an interactive and engaging learning environment that encourages learners to actively participate in discussions and exercises and fosters a sense of teamwork and collaboration among the group.

# Learning Unit 5.1: Mainstreaming Disaster Risk Management and Climate Change Adaptation into Urban Development Planning

**Brief Description of the Learning Unit**

The learning unit "Mainstreaming Disaster Risk Management and Climate Change Adaptation into Urban Development Planning" explains how to incorporate disaster risk management (DRM) and climate change adaptation (CCA) into urban development planning. It discusses a variety of topics, including the significance of mainstreaming DRM and CCA, the mainstreaming process, and initiatives in this regard through case studies.

**Learning Objectives**

- To investigate various methods for incorporating disaster risk management and climate change adaptation into urban development planning
- Identify good practices and lessons learned from case studies of cities that have successfully integrated disaster risk management and climate change adaptation into their urban development planning

**Duration:** 60 min

**Methodology**

- Lecture
- Discussion

**Detailed Description**

To reduce the existing risks and prevent the creation of new disaster and climate risks in urban areas, disaster risk management, and climate change adaptation must be integrated into urban development planning. There are various methods for mainstreaming disaster risk management and climate change adaptation into urban development planning.
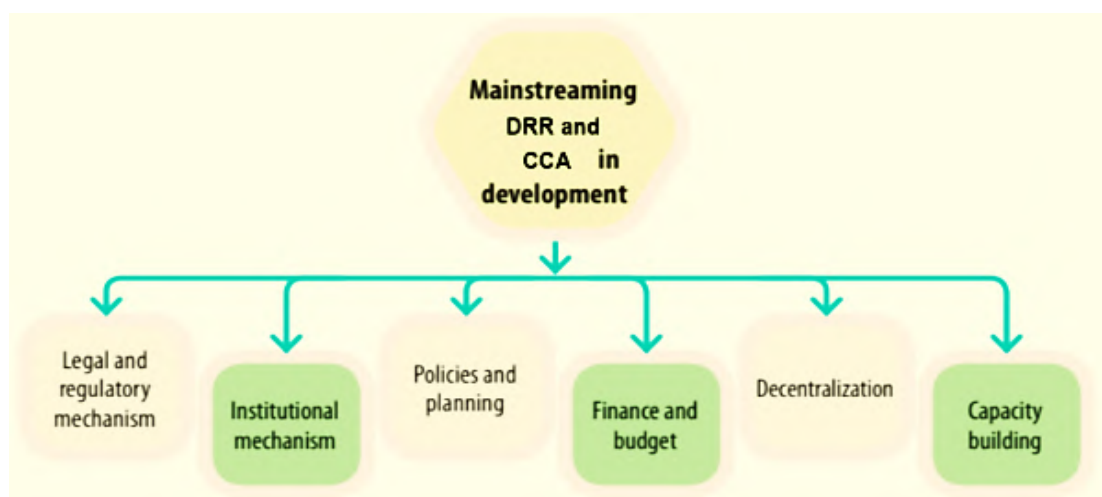


*Fig 1. Principles of Mainstreaming DRR and CCA (UNESCAP 2017)*

Some of the key mentions of mainstreaming DRR and CCA into urban development planning can be found in the global frameworks, national policies, and acts as follows:

**1. Global**

- **Hyogo Framework for Action (HFA) 2005-2015**, endorsed the linkage of DRR with sustainable development. It focussed on increasing knowledge and developing priorities for DRR and reinforcing resilience.

- **Sendai framework for DRR 2015-2030** emphasizes reducing risk through integrated and inclusive measures to reduce disaster risk, increase preparedness, and strengthen resilience
- **2030 Agenda for Sustainable Development** also recognizes the urgent need to reduce the risk of disasters. The targets of SDGs 7, 9, & 11 establish the direct interrelatedness between urban resilience and sustainable development.
- The **Synthesis Report of IPCC Sixth Assessment** highlights the mainstreaming of climate action across policy domains and levels. It notes that climate-resilient development benefits from drawing on diverse knowledge. It mentions that key adaptation and mitigation in cities include considering climate change impacts and risks in the design and planning of infrastructure; land use planning to achieve compact urban form, co-location of jobs and housing, etc.

## 2. National

- Aligning with the perspectives of HFA, the GoI to take measures for disaster management developed the **DM Act, 2005,** calling for the integration of preventive/mitigating measures in India's development plans.
- **Constitution (74th Amendment) Act 1992**, targeted to strengthen municipal governance in India by providing a framework for the development of urban areas through a decentralized three-tiered planning structure. Provisions under the 74th CAA unlock the potential for the incorporation of urban disaster risk reduction strategies into the city and regional plans.
- **The Tenth Five-Year Plan (2002-2007)** first time included a separate chapter on taking the planned route to mainstream/integrate DRR measures and the Twelfth Five-Year Plan (2012-2017), devoted attention to addressing DRR measures in various sectors. According to the Planning Commission report of the Twelfth Five-Year Plan mainstreaming means that "risk reduction becomes a practice of all partners involved in development work by institutionalizing the process in planning and implementation and policies." The Twelfth Plan emphasised that each project should be appraised based on a detailed assessment of hazards, risks and vulnerabilities.
- **Directive from the Planning Commission** called for the inclusion of mandatory components on DRR in State Annual Plans from the year 2014-15 onwards. This directive also stated that the Planning Commission will initiate steps to mainstream DRR in all major schemes of the Government of India by incorporating the same in the Five-Year Plan of the Central Ministries and the annual plan of state governments.
- **NITI Aayog** replaced the Planning Commission in 2015 and highlighted the need to promote sustainable technologies to offer safer and disaster-resilient affordable housing among other aspects. Under its ThreeYear Action plans, initiatives like crop insurance to minimize losses due to disasters, and low-cost and disaster-resilient housing models are promoted to be taken on a priority basis with dedicated project management units at the state level to coordinate the progress.
- **Guidelines from the Ministry of Finance** make provision for 25% flexi-funds within Centrally Sponsored Schemes of every Ministry / Department to be utilized inter alia for mitigation and restoration activities in line with the overall aim and objectives of the approved scheme.

Although context-specific, the framework for mainstreaming is important to ascertain progress in the different spheres as mentioned in Fig 2. Mainstreaming is not a linear process and the spheres are interlinked and interact thus making the framework flexible.
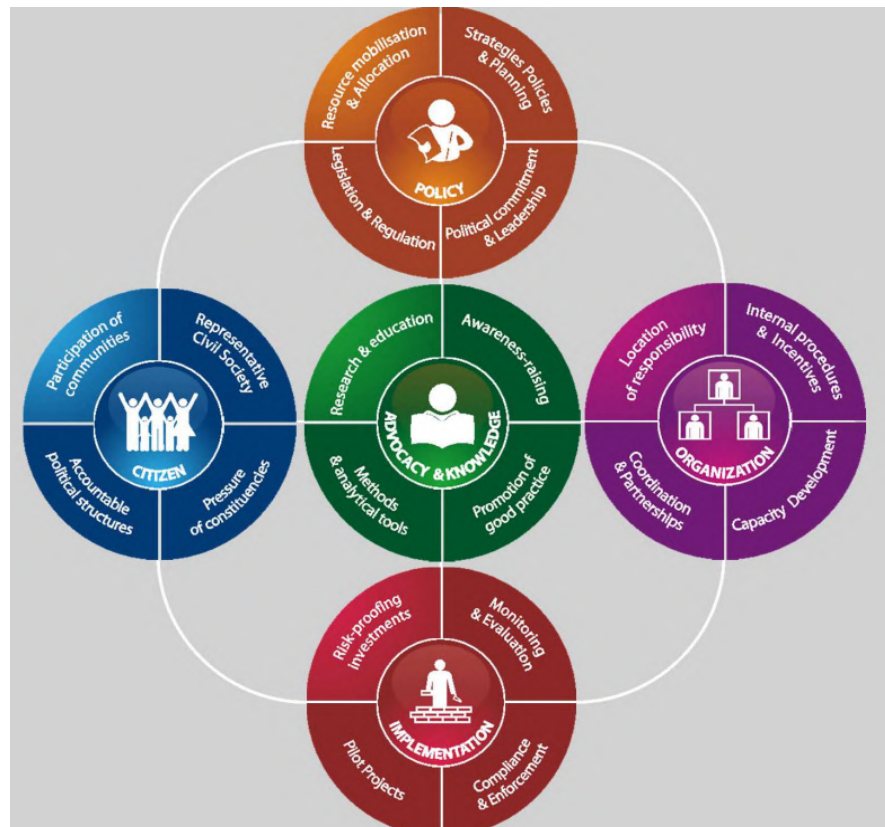
*Fig 2. Framework for Mainstreaming DRR and CCA into Development (UNESCAP, 2017)*

**a. Policy sphere:** This addresses what legislation/ regulations and what existing urban planning frameworks and policies are in place. Identifying existing urban planning frameworks and policies is an important step toward incorporating disaster risk management and climate change adaptation into urban planning. This entails reviewing and analyzing current policies and frameworks that guide urban development and planning decisions at the local, regional, and national levels (UNDRR, 2020). Some of the key efforts on urban governance that support DRR are Coastal Regulation Zone (CRZ) 1984, NDMA Guidelines

In Gujarat, the state government has initiated the process of identifying existing urban planning frameworks and policies to integrate disaster risk reduction and climate change adaptation into urban development. The Gujarat State Disaster Management Authority (GSDMA) has been working towards mainstreaming disaster risk reduction and climate change adaptation into urban planning by developing guidelines for urban planners and local authorities. Eg. the Gujarat Emergency Earthquake Reconstruction Project and special package for housing assistance to the earthquake-affected tenants of Bhuj & Anjar cities.

**b. Organization sphere:** This addresses if departments have focal points for DRR and CCA, there are collaborative efforts, training, etc.

The **SAPCC (State Action Plan on Climate Change)** is a plan developed by Gujarat's Department of Climate Change (Government of Gujarat, 2014) The plan focuses on nine thematic areas, with participating technical representatives from state government departments, research institutes, international development organizations, and non-governmental organizations (NGOs). This fosters a partnered approach to mainstreaming DRR and CCA. The thematic groups are largely consistent with the National Action Plan on Climate Change while also addressing key state priorities. The Gujarat SAPCC goes beyond what has been proposed under the NAPCC's National Missions and addresses

key issues such as health, sea level rise and coastal infrastructure, vulnerable communities, and green jobs.



*Fig 3. The 9 Themes of SAPCC, Gujarat (Government of Gujarat, 2014)*

**c. Implementation Sphere:** This addresses if hazard (climate) risk assessments are carried out before construction if there are performance indicators, building codes, etc. Risk assessment is a systematic process of evaluating the likelihood and consequences of an adverse event and the effectiveness of existing or proposed risk management measures (UNGA, 2016). Risk assessment is essential to urban development planning to identify and prioritize risks, inform decision-making, allocate resources, and monitor progress toward reducing risks. There are different types of risk assessments, including hazard assessment, vulnerability assessment, and scenario planning. These can use historical data-based modeling, expert opinion surveys, and geotechnical surveys to identify hazard-prone zones. For e.g: A geological survey identifies fault lines for earthquakes.
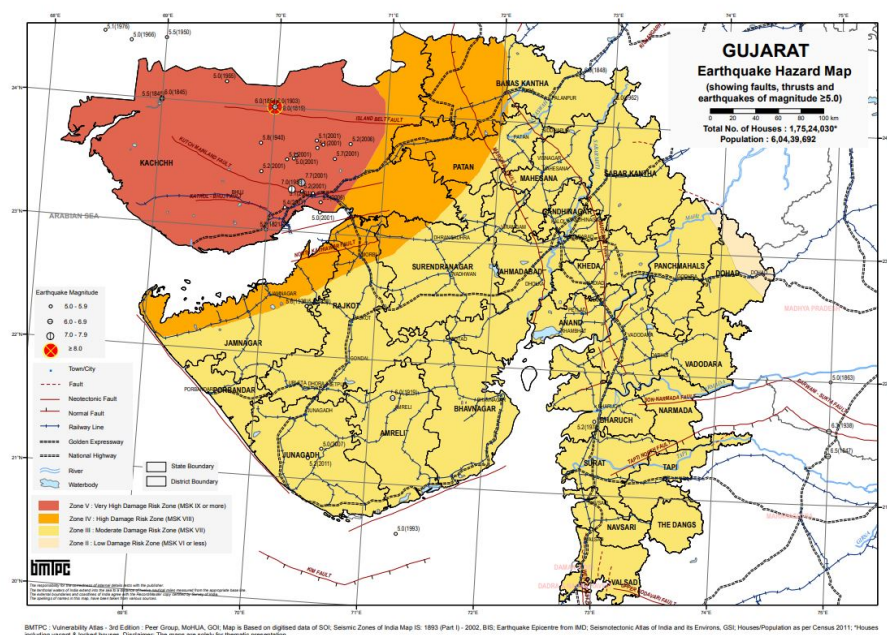


*Fig 4. Earthquake Hazard Map (BMTPC, 2019)*

This leads to the identification of high-risk, low, and medium-risk zones based on DRR and CCA. This involves analyzing risk maps, based on the hazard risk analysis to further formulate strategies. **Gujarat Comprehensive Development Control Regulations** enforce the regulations for buildings constructed in these specific risk zones. It also supports the Technical Audit of Construction.

Based on the risk assessment and identification of vulnerable areas, DRR and CCA strategies and action plans should be developed. This includes both structural and non-structural measures. These can be important components of mainstreaming disaster risk management (DRM) and climate change adaptation (CCA) into urban development planning (UNGA, 2016).

 Eg: CapaCITIES Project Rajkot City Film by NIUA **https://www.youtube.com/watch?v=Yy3duEaOqkk**

**d. Citizen sphere:** These are guided by decentralized political structures and address questions like are local civil society groups and at-risk communities participate in development planning

Multi-stakeholder engagement and participation: This method entails bringing together a variety of stakeholders, such as government officials, local communities, the private sector, and civil society organizations, to identify and address urban risks and vulnerabilities.

 Eg: Community members work together for disaster risk reduction by UNICEF Philippines **https://www.youtube.com/watch?v=QyH6htOsSMk**

Institutional and Stakeholder capacity building: This involves building the capacity of local institutions and communities, such as local government agencies, to better manage disaster risks and adapt to the impacts of climate change.

**e. Advocacy and Knowledge Sphere:** This considers the level of integration of DRR and CCA awareness as part of professional training courses, incorporation into school curricula, improved methods and tools, etc.

Promotion of disaster management activities through recognitions like Subash Chandra Bose Aadpda Prabandhan Puraskar that recognise and honour the contribution and service rendered by individuals and organisations also are steps towards mainstreaming DRR and CCA.

 Eg: School Safety Plans in India, public awareness programmes Video: Why Odisha is a role model for disaster preparedness by UNDRR **https://www.youtube.com/watch?v=2ivFrzd0f6M**

Usually, mainstreaming DRR and CCA into urban development planning can involve the steps as shown in the figure. The developed tools and strategies should be integrated into the existing urban planning frameworks and policies. This can be done by updating urban planning guidelines, codes, and regulations.
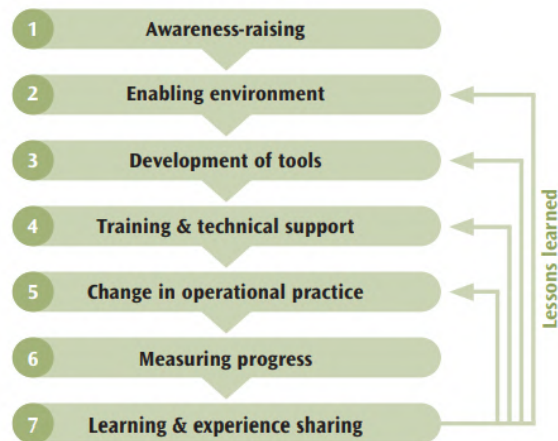
*Fig 5. Steps for Mainstreaming DRR (Benson et. al, 2007)*

## Case Studies

1. **Ahmedabad Heat Action Plan:** The Ahmedabad Heat Action Plan (HAP) is an initiative that aims to build resilience to heat waves in the city. The HAP was developed in 2013 and involves collaboration between various stakeholders, including the Indian Institute of Public Health, the Natural Resources Defense Council, and the Ahmedabad Municipal Corporation. The HAP includes early warning systems, public awareness campaigns, and interventions such as cooling shelters and water distribution during heat waves. The HAP has been successful in reducing the number of heat-related deaths in Ahmedabad (Ahmedabad Municipal Corporation, 2016). The development of HAP has led to activities like capacity building of primary healthcare staff on heat-related issues, improved tracking of heatstroke incidents by the health department, knowledge sharing through Training Modules on Extreme Heat Prevention and Management, Traffic Police on Heat Wave Preparedness, Heatwave Prevention by GIDM for participants working in various government and non-government organizations. Special efforts are made by AMC to reach vulnerable populations through interpersonal communication as well as other outreach methods through NGOs and CBOs.

     Video: Fighting urban heatwaves: Ahmedabad Heat Action Plan by Sustainable Energy for All **https://www.youtube.com/watch?v=HvqH98imqd8&t=36s**

2. **Sabarmati Riverfront Development:** The Sabarmati Riverfront Development is a project aimed at revitalizing the Sabarmati riverfront in Ahmedabad. The project involves urban planning, infrastructure development, housing and commercial development, environment and ecology, and social and cultural development. The project integrates disaster risk management and climate change adaptation considerations into its design and implementation. For example, the project includes flood protection measures, such as retaining walls, to reduce the risk of flooding in the area. It integrated the rehabilitation of urban poor residing in flood-prone areas and minimized the risk of flooding for these many poor communities. It also contributed to environmental protection by creating open green spaces for the public, biodiversity parks, and diversion of sewage away from the water body. The project has been successful in transforming the Sabarmati riverfront into a vibrant urban space. (Government of Gujarat, 2023)

3. **Integrated Land Use Planning, New Zealand post-Canterbury earthquake:** One of the first countries to develop an integrated risk management framework was New Zealand. It had over the years included four Rs- risk reduction, readiness, response, and recovery in the governance system

to provide a comprehensive approach to development. After the reforms of the 1990s, the country moved towards enhancing the decentralized solutions and implementation of localized actions led in an open and pluralistic fashion for encouraging a critical discourse, that gradually became an essential part of the regulatory process. To address the environmentally sensitive areas, a statutory framework for environmental risk management was planned to devise an integrated approach. For the implementation of localized solutions, it was assessed that all-embracing coordination and cooperation among departments and all levels of government, the private sector, and other stakeholders are suitable.

The city hired consultants to map the land zones based on the need for recovery and reconstruction. The identified red zones were unsuitable for construction. A government buyout program was introduced to buy back properties in the residential red zone. The Central Christchurch City Recovery Plan addresses the development and reconstruction of the Christchurch CBD. Additionally, the Land Use Recovery Plan was designed for the greater city limits. The plan included issues like the introduction of new greenfield areas for development and enhanced development mechanisms by redefinition of criteria for compliant and non-compliant activities.

## Session Plan

| Content | Trainer's Note | Time |
|---------|---------------|------|
| Introduction | Focus on giving a brief on the learning unit, with a focus on drawing insights from the history, urban resilience and its importance and the principles of mainstreaming | 15 min |
| Framework for Mainstreaming | Focus on explaining policy, organization, implementation, citizen, and advocacy sphere, with more focus on the ways these can be integrated into the development | 30 min |
| Case Studies and Discussion | Focus on promoting the knowledge of the overview, and the impacts | 15 min |

## References

- Ahmedabad Municipal Corporation. (2016). Ahmedabad Heat Action Plan 2016 - Guide to extreme heat planning in Ahmedabad, India. 24.
- Government of Gujarat. (2014). State Action Plan on Climate Change, Government of Gujarat. http://gujenvis.nic.in/PDF/Gujarat-SAPCC.pdf
- Government of Gujarat. (2023). Sabarmati Riverfront Project.
- Benson, Charlotte & Twigg, J. & Rossetto, Tiziana. (2007). Tools for Mainstreaming Disaster Risk Reduction: Guidance Notes for Development Organisations.
- IPCC (2023). Synthesis report of the IPCC sixth assessment report (AR6). Summary for Policymakers. https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_SPM.pdf
- UNDRR. (2020). Disaster Risk Reduction and Climate Change Adaptation: Pathways for policy coherence in Sub-Saharan Africa. 80.
- UNGA. (2016). Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction (Vol. 21184, Issue December).
- UNISDR. (2012). How to Make Cities More Resilient: A Handbook for Local Government Leaders.

- UNESCAP (2017) Mainstreaming DRR/CCA into Development https://www.unescap.org/sites/default/files/Mainstreaming%20DRR%20and%20CCA%20into%20development%20by%20Sanny%20Jegillos.pdf

## Additional Reading Material
- Unpacking Mainstreaming DRR-CCA in the sub-national level Development Planning: Insights from three states in India https://www.preventionweb.net/publication/unpacking-mainstreaming-drr-cca-sub-national-level-development-planning
- OECD. (2023). Resilient Cities. https://www.oecd.org/cfe/resilient-cities.htm#:~:text=Resilient cities are cities that, cities can increase their resilience.
- Mainstreaming Disaster Risk Reduction for Sustainable Development: A Guidebook for the Asia-Pacific
- https://repository.unescap.org/bitstream/handle/20.500.12870/89/ESCAP-2017-MN-Mainstreaming-disaster-risk-reduction-for-sustainable-development.pdf?sequence=1

# Notes

# Learning Unit 5.2: Multi-sectoral Risk Management

## Brief Description of the Module

The learning unit on multi-sectoral risk management informs learners on the value of multi-sectoral and inter-departmental coordination and collaboration in risk management, especially in the context of disaster risk reduction (DRR) and climate change adaptation (CCA). The unit discusses the historical growth of inter-departmental/ multi-sectoral risk management and how it became a common approach to DRR and CCA. It also analyses the advantages of putting such a strategy into practice and offers instructions on how to create and keep up efficient inter-departmental/multi-sectoral coordination systems through a case study in Gujarat.

## Learning Objectives

- To recognize the importance of an inter-departmental/ multi-sectoral approach to risk management
- To discover the fundamental concepts and methods of multi-sectoral risk management, including how to create fruitful alliances and include stakeholders from all spheres of influence

**Duration:** 60 min

## Methodology

- Lecture-based learning
- Discussion

## Detailed Description

The coordinated effort and collaboration between different government departments, agencies, and other stakeholders from private, academia, civil society, etc. to manage and address risks are referred to as multi-sectoral risk management. It entails identifying, assessing, and managing existing, emerging, and future risks with a holistic focus on coordination and collaboration of multiple departments/sectors such as health, education, transport, and public works, as well as developing policies and strategies to mitigate or adapt to those risks. Disaster risk governance involves different societal actors and power holders. There are different relationship models for interaction among the state, private sectors, NGOs, and the market. Each sector mediates the relation and interaction of the other two concerning the market. These relationship models result in the different phenomena of public partnership, public-private partnership, and corporate-citizen cooperation.



*Fig 1. Triadic model of public, private, and NGO sectors (Adapted from Lassa, et al, 2018 and Wright, 2011)*

## Importance of Multi-sectoral Risk Management

- **Evolving Emphasis on Multi-Hazard Approach:** Novel reports and frameworks on DRR and CCA have emphasized for multi-hazard-based approach, instead of a hazard-to-hazard approach. This is significant as the 2019 Global Assessment Report states that multi-hazard disasters

affected 88 million people in Sendai Framework Monitoring countries, followed by floods affecting 76 million people, in the period 1997–2017 (UNDRR, 2019). These intricate relationships between hazards can be found and addressed with the use of multi-sector risk management. Activities that engage stakeholders from diverse sectors make significant impacts.

**SCAN ME**    Eg. Multi-hazard risk reduction in response to COVID-19 by UNDRR **https://www.youtube.com/watch?v=zPoe-cpInT4**

- **Comprehensive Management than the Siloed Approach for Risk Management:** Resource sharing allows departments and sectors to use their resources, knowledge, and experience efficiently and effectively. This improves disaster preparedness and resilience. Multi-sectoral risk management helps to build community resilience by ensuring that all sectors and departments work together to address the needs of communities in the face of disasters (Schweizer, 2019).
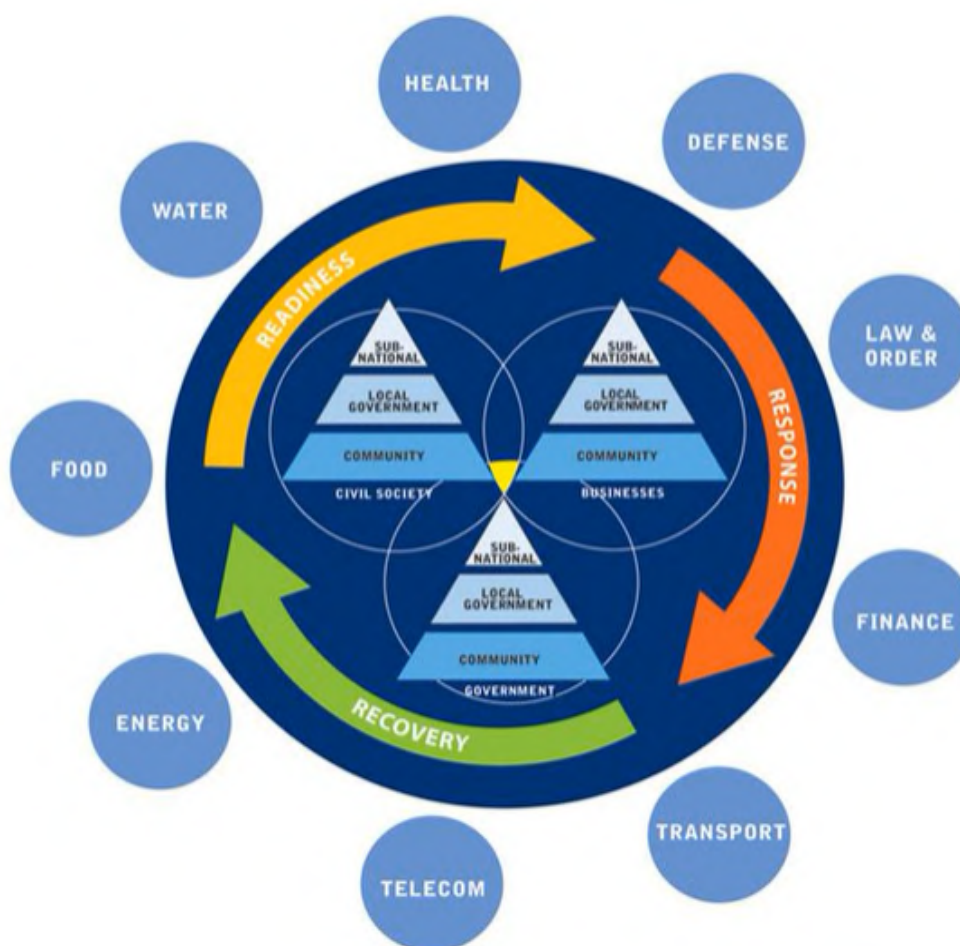


*Fig 2. Whole-of-Society Approach (WHO, 2009)*

Cooperation and shared responsibility between local authorities, various sectors, and stakeholders are essential for risk management. The Whole-of-Society approach ensures effective resource mobilization for disaster risk management and collaboration among the sectors. It highlights the key sectors and essential services for risk management. This approach breaks the silo-based approach and brings in the importance of cross-cutting sectoral planning in DRM.

- **Interconnected Systems and Emerging Risks:** Systems are more interconnected than before (UNDRR, 2019). This has led to the emergence of risks that cascade, and generate amplified effects. E.g.: Systemic risks are those that arise from the interconnectedness and interdependencies of systems, such as the global financial system, and can lead to large-scale, widespread impacts (Schweizer, 2019). Cascading risks, on the other hand, occur when the impacts of a hazard in one system trigger impacts in another system, which in turn trigger impacts in another system, and so on (Pescaroli & Alexander, 2015). Assessment, timely identification and management of such complex nature of risk call for robust multi-sectoral coordination and collaboration. Eg: During the extremely Severe Cyclonic Storm "Tauktae" the district administrations in coastal areas received alerts from the Government of Gujarat to ensure the evacuation of at-risk populations to safe places. It planned for related logistics and alerted the fisherman communities. Inter-Agency Group of Gujarat held coordination meetings to prepare and plan imminent responses and joint rapid needs. The state government directed neighbouring states to maintain a buffer of 2 days' oxygen supply as the oxygen supply line to several states was expected to be disrupted. District Disaster Management Authorities ensured its compliance to COVID-19 related SOPs in shelters and patients from high-risk locations have been moved to safer places by Government.

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**Global History of Interdepartmental/multi-sectoral risk management:**

The concept of interdepartmental/multisectoral risk management dates back to the twentieth century when governments recognized the need to coordinate disaster management efforts across multiple agencies and sectors. The United Nations was established in 1945 to provide a platform for international cooperation and collaboration. The International Decade for Natural Disaster Reduction (IDNDR) was established by the United Nations General Assembly in 1989 (Hays, 1990) to reduce the effects of natural hazards through a coordinated, interdepartmental approach.

Following this, the Hyogo Framework for Action was adopted in 2005 (UNISDR, 2005), emphasizing the importance of interdepartmental and multisectoral collaboration to reduce disaster risk. The Sendai Framework for Disaster Risk Reduction (2015-2030) stresses the importance of shared responsibilities for interdepartmental and multisectoral collaboration, calling for DRR and CCA to be integrated into all relevant policies and plans. The Sustainable Development Goals (SDGs) of 2015, recognize the importance of interdepartmental and cross-sectoral collaboration in achieving sustainable development.

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Methods to formulate a multi-sectoral risk management framework for urban governance (WHO, 2020, 2022):

*Trainer should guide the learners to list down relevant points specific to their department*

**1. Describe the Goals**: Specify the overarching goals of the framework, along with the results you want to achieve and the Key Performance Indicators (KPIs) you'll use to monitor your progress.

List the goals and indicators of the urban governance project by your department:

_____

_____

_____

_____

2. **Determine Key Stakeholders**: List the important parties participating in the risk management process, such as governmental agencies, businesses, and civil society organizations. To secure their support and ownership of the framework, involve key stakeholders in its creation.

List key stakeholders for your department:

_____
_____
_____
_____

3. **Conduct a Multi-hazard Risk Assessment**: To determine the main risks and vulnerabilities facing each stakeholder, do a thorough risk assessment. All relevant risks, such as those arising from natural hazards, anthropogenic hazards, climate change, or a combination thereof, should be taken into account in this evaluation along with a consideration of underlying and systemic conditions that can influence (mitigate or aggravate) the identified risk.

List the risks and factors that mitigate and aggravate these risks:

_____
_____
_____
_____

4. **Create Departmental/Sectoral Risk Management Plans**: Create risk management plans that handle the identified risks based on the findings of the risk assessment and vulnerability analysis. The plans should include the roles and responsibilities of each associated department and stakeholder.

List the risk management, urban planning, and land-use management plans created by your department. Are all the risks identified in the previous step covered by these plans? :

_____
_____
_____
_____

5. **Establish an Inter-departmental/ Multi-Sectoral Governance Structure:** Establish an inter-departmental/ multi-sectoral governance structure that includes representatives from all relevant government agencies, private sector organizations, and civil society groups. This structure should be responsible for overseeing the implementation of the plan and ensuring that all stakeholders are engaged and involved.

Does your department have a multi-sectoral governance structure for the implementation of the plans? What roles do different stakeholders take? :

_____
_____
_____
_____

**6. Develop an Implementation Plan**: Develop a detailed implementation plan that outlines the specific actions that will be taken to implement the plan, including timelines, resource and funding requirements, and responsibilities.

List the key elements of the implementation plan for risk management plans of your department:

_____

_____

_____

_____

**7. Monitor and Evaluate Progress**: Monitor and evaluate the progress of the plan on an ongoing basis, using the key performance indicators identified in the objectives. Use this information to make any necessary adjustments to the plan and to ensure that it remains effective and relevant over time.

## Case Study

### 1.Ahmedabad Integrated Command and Control Centre (ICCC), Paldi

The Integrated Command and Control Centre (ICCC) in Ahmedabad is an innovative platform that integrates various smart city solutions, including real-time data monitoring, intelligent traffic management, smart street lighting, and others, to improve the city's overall governance and management. The ICCC is operated by the Ahmedabad Municipal Corporation (AMC), which is the primary governing body responsible for managing the city's infrastructure, services, and facilities.

The ICCC brings together multiple sectors, including transportation, public safety, energy, water, and waste management, under one roof, with the aim of enhancing inter-departmental coordination and collaboration (MoHUA, 2015). The platform also facilitates real-time monitoring of critical infrastructure and services, enabling timely decision-making and effective management of the city's resources.

**a.Underlying Need, Aim, and Goals of ICCC:** The need for an ICCC in Ahmedabad arises from the city's growing urbanization and the associated increase in complex challenges related to urban management, such as disaster management, traffic management, and public safety. The ICCC is aimed at addressing these challenges through a collaborative approach, bringing together various stakeholders from different sectors and domains to work towards the common goal of enhancing the livability, sustainability, and resilience of the city. By coordinating and integrating the efforts of different agencies and departments, the ICCC can help in the effective management of emergencies, optimize the use of resources, and improve the overall quality of urban services.

**b. Underlying Regulations and Schemes:** In terms of laws and regulations, the ICCC in Ahmedabad is guided by the Smart Cities Mission, which was launched by the Government of India in 2015(MoHUA, 2015). The mission aims to promote sustainable and inclusive urban development by providing financial and technical assistance to cities nationwide to leverage technology and innovation for improving urban services and infrastructure. The ICCC forms a key driver to sustainable management of the city infrastructures, as it helps to reduce key challenges such as poor waste management, and so on.

**c. Key Funding Sources:** The project has been funded by Ahmedabad Municipal Corporation and Smart City Ahmedabad Development Limited. The total cost of the project is estimated at 310 crores and was launched under the Safe and Secure Ahmedabad Project (SAVA), by the Smart City Ahmedabad Development Limited (DeshGujarat, 2018).

**d. Working Mechanism:** The Ahmedabad Integrated Command and Control Centre (ICCC) is an advanced system that involves over 6,000 cameras, 130 zero-tolerance junctions, 25 IoT environmental sensors, 126 LED displays, and 45 Wi-Fi locations. The system ensures the safety and security of the citizens by providing real-time monitoring of the city through more than 6,000 CCTV cameras installed at over 1,000 locations, including 158 Bus Rapid Transit System (BRTS) stations. The cameras record any misconduct, which helps the concerned departments take faster decisions. In addition, 146 VMDs (display boards) are installed at various locations in the city to keep citizens well-informed in times of emergency. The system also ensures cleanliness in the city by tracking over 1,120 solid waste management vehicles equipped with GPS, which collects waste from the city's various points of interest. The environmental sensors installed in the city measure light intensity, temperature, water level, air pollution, noise pollution, and humidity, and help the government monitor the environment and reduce health hazards in the city. The Comprehensive Complaint Redressal System (CCRS) is an enterprise solution that automates the entire complaint process from registration to closure, enhancing citizen satisfaction through efficient service delivery. The system allows citizens to lodge complaints through a call center, website, or by visiting the ward. The smart parking sensors installed by AMC allow citizens to monitor real-time data on available and unavailable parking spots in the city, saving time, resources, and effort. The system also ensures better traffic control through Automatic Number Plate Recognition (ANPR) and Red Light Violation Detection (RLVD), which automatically issues E-Challans to violators. Furthermore, the city has launched free public Wi-Fi services on 145 BRTS stations through its dedicated 180 km long optical fiber cable network, with free internet access available at a speed of 2 Mbps.

**e. Governance Framework:** The Municipal Commissioner is the chief executive of the municipal corporation and plays a key role in the governance of the ICCC. The Commissioner heads the ICCC and is responsible for the overall management of the center. The Commissioner is supported by a team of officials from various departments, including IT, urban planning, transportation, and emergency services.

The governance framework of the ICCC also involves the participation of citizens and other stakeholders. Citizens are provided with a range of tools and platforms to provide feedback, suggestions, and complaints related to city management. The ICCC uses this feedback to improve the quality of services and enhance the overall governance of the city.
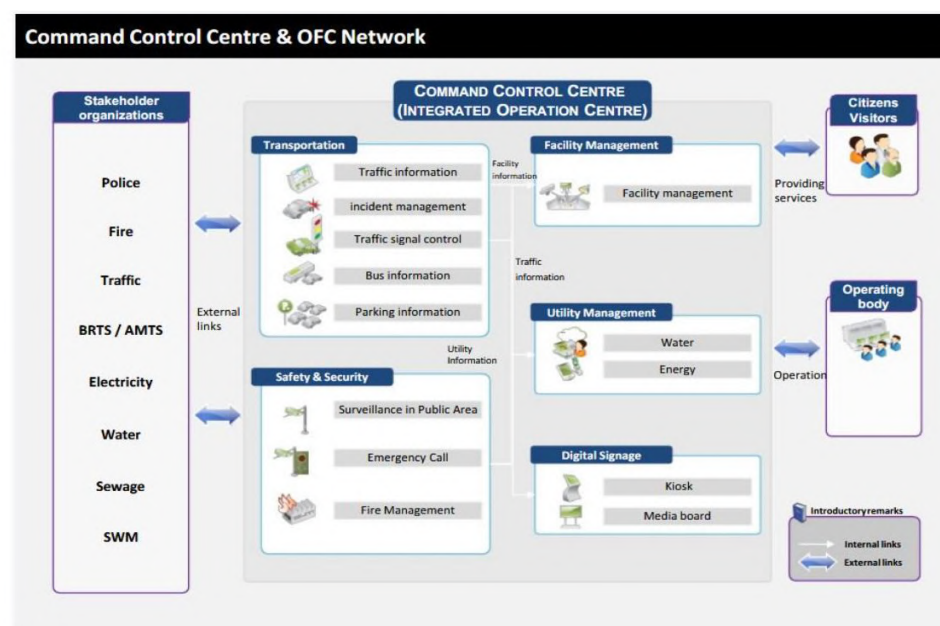


*Fig 3. Governance Network (DeshGujarat, 2018)*

The key stakeholders involved include the following (DeshGujarat, 2018):

- Ahmedabad Municipal Corporation (AMC): The AMC is the city's governing body and is in charge of planning and overseeing many civic services.

- Gujarat Pollution Control Board (GPCB): The GPCB is a regulatory organization in charge of keeping an eye on and regulating pollution in Gujarat state.

- Gujarat Electricity Regulatory Commission (GERC): The GERC is the regulatory agency in charge of overseeing the growth and management of the state's electrical industry.

- Ahmedabad Traffic Police: The traffic police are responsible for managing and regulating traffic in the city

- Ahmedabad Fire and Emergency Services: The fire and emergency services department is responsible for responding to fire emergencies and other emergencies in the city.

- Public Health Department: The public health department is responsible for monitoring and controlling the spread of diseases in the city.

- Water Supply and Sewerage Board: The water supply and sewerage board is responsible for providing clean and safe water supply and managing the sewerage system in the city.

- Information Technology Department: The IT department is responsible for implementing and managing various technology initiatives in the city, including the ICCC.

- Citizens and External Stakeholders: The sector plays a key role in the ICCC, as it provides expertise, resources, and support for various initiatives and projects in the city.

**f. Impact of ICCC:** There has been a key impact of ICCC in Ahmedabad. Some of the relevant ones are as follows:

Environmental Management
- The city administration aimed to have close monitoring of air quality in the city by using environmental sensors and analyzing the gathered data for health-related initiatives. This led to the deployment of environmental sensors at 50 identified locations in the city (MoHUA, 2015).
- ICCC team collates and shares the captured data from sensors and transfers it to the health department for targeted intervention

Impact: The air quality monitoring helped the city to keep a record of key AQI parameters and initiate targeted intervention in case of concern.

COVID-19 Management
In the context of the COVID-19 pandemic, ICCC was used as a central hub for monitoring and managing various aspects of the pandemic response, such as tracking the movement of people, monitoring the availability of essential supplies, and coordinating the activities of different agencies involved in the response. It helped in streamlining the communication and collaboration among different departments and agencies and enabled them to respond quickly to emerging challenges. Advanced Covid-19 Syndromic Surveillance (ACSyS) System is an epidemiological and technological solution to the problem with existing surveillance of COVID-19 technology. It uses Mobile App for data entry by end users and a Web portal for a Decision Support System based innovative syndromic surveillance system targeted to identify hotspot areas with increased cases of Fever, Cough, Difficulty in Breathing, Cold, and Throat Pain (five cardinal signs & symptoms of COVID19) and take timely evidence-based actions to contain the further spread of disease in the community.

**Session Plan**

| Content | Trainer's Note | Time |
|---|---|---|
| Introduction, Importance of multi-sectoral risk management | The trainer should focus on explaining the concept to the learners, and explain the need for multi-sectoral risk management in the current scenario | 15 min |
| Methods to Formulate multi-sectoral risk management plan for urban governance | The trainer should speak on the key methods to formulate a multi-sectoral risk management framework. Along with engaging learners as a part of the exercise | 20 min |
| Case Study | The case study should be explained in a way that highlights the multi-sectoral collaborations and could also highlight the potential of the case study into furthering city resilience | 25 min |

**References**

- DeshGujarat. (2018). gets Central Command and Control Centre at Paldi. 1–6. https://www.deshgujarat.com/2018/02/23/ahmedabad-gets-central-command-and-control-centre-at-paldi/
- MoHUA. (2015). Model RFP 2 . 0 Selection of Master System Integrator (MSI ) For Implementation of Integrated Command and Control Center ( ICCC )/ ICT Projects Section-1 Volume II : Scope of Work Core Infrastructure: Vol. II. https://iccc.smartcities.gov.in/index.php#
- OECD. (2023). Resilient Cities. https://www.oecd.org/cfe/resilient-cities.htm#:~:text=Resilient cities are cities that,cities can increase their resilience.
- Pescaroli, G., & Alexander, D. (2015). A definition of cascading disasters and cascading effects : Going beyond the " toppling dominos " metaphor. GRF Davos Planet@Risk, 3(1), 58–67.
- Sarkar, A., & Chouhan, P. (2021). COVID-19: District level vulnerability assessment in India. Clinical Epidemiology and Global Health, 9(September 2020), 204–215. https://doi.org/10.1016/j.cegh.2020.08.017
- Schweizer, P. (2019). Governance of Systemic Risks for Disaster Prevention and Mitigation Contributing Paper to GAR 2019. https://www.preventionweb.net/files/66695_f431finalschweizergovernanceofsyste.pdf
- UNDRR. (2019). United Nations Office for Disaster Risk Reduction To download the full report visit : https://gar.unisdr.org To share your comments and news on the GAR on Twitter and Facebook , please use # GAR2019.
- UNDRR. (2020). Disaster Risk Reduction and Climate Change Adaptation: Pathways for policy coherence in Sub-Saharan Africa. 80.
- UNGA. (2016). Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction (Vol. 21184, Issue December).
- WHO. (2020). Multisectoral preparedness coordination framework.
- WHO. (2022). Toolkit for developing a multisectoral action plan for noncommunicable diseases Module 2. Establishing stakeholder engagement and governance mechanisms.

**Additional Reading Material**

- Multisectoral preparedness coordination framework https://apps.who.int/iris/rest/bitstreams/1278937/retrieve

- Stakeholder Engagement Mechanism: UNDRR document https://www.undrr.org/sites/default/files/inline-files/SEM_2020_04_17.pdf
- Stakeholders' approaches to disaster risk reduction in built environment https://www.researchgate.net/publication/265969484_Stakeholders'_approaches_to_disaster_risk _reduction_in_built_environment

# Notes

## Brief Description of the Learning Unit

The group exercise of creating a mechanism that brings together different sectors and stakeholders to address various types of risks and challenges in urban areas in Gujarat involves creating a mechanism which brings together different sectors and stakeholders to address various types of risks and challenges in urban areas. The mechanism should encourage collaboration and coordination among various departments, agencies, and organizations in order to improve disaster and emergency preparedness, response, and recovery.

## Learning Objectives

- To develop a comprehensive and integrated approach to urban risk governance by establishing a multi-sectoral institutional mechanism that includes relevant stakeholders from different sectors
- To provide a guide for drafting an institutional mechanism to manage and mitigate urban risks in Gujarat.

**Duration:** 60 minutes

## Methodology

- Group exercise
- Discussion

## Materials Needed

- Flip chart paper for each group
- Coloured markers
- Post-it notes in multiple colors

## Detailed Description

The state of Gujarat was affected by cyclone Tauktae during the COVID-19 Pandemic, in May 2021. The cyclone caused widespread damage to infrastructure, property, and crops, and resulted in several casualties. Some of the impacts of Cyclone Tauktae on Gujarat during the pandemic include:

1. **Disruption of COVID-19 relief efforts:** The cyclone hit at a time when Gujarat, like the rest of the country, was grappling with the second wave of COVID-19. The cyclone disrupted the ongoing relief efforts, including vaccination drives, oxygen supply, and medical supplies, further straining the already burdened healthcare system.
2. **Damage to infrastructure and property:** Cyclone Tauktae caused extensive damage to infrastructure, including power lines, roads, and buildings. Many people lost their homes, and some had to be evacuated to safer areas. The damage to infrastructure and property has made the recovery process even more challenging for the state (Al Jazeera, 2021).

In Gujarat, power outages were reported from 5,951 villages, including 52 COVID-19 hospitals and 13 oxygen plants. Further, water supply systems were damaged in 5,951 villages. More than 200,000 people in Gujarat have been evacuated from coastal areas, as a result of these.

Based on this issue, the government has decided to formulate an urban risk management for health infrastructures. For this purpose, the team needs to formulate an institutional mechanism for urban health infrastructure risk governance for multi-hazard management.

The following steps need to be taken as a part of the exercise:
- Divide learners into small groups of 4-5 people each with representatives from different sectors.

- Assign one or more sectors relevant to urban risk governance to each group, such as:
  - Infrastructure
  - Environment
  - Health Department
  - Social Development/ Security
- Ask each group to identify the main challenges that their assigned sector faces in urban areas of Gujarat. They should take into account both natural and human-induced hazards, as well as emerging risks like climate change and technological disruptions.
- Have each group brainstorm a set of measures or interventions that could help mitigate or manage the identified risks. These measures should be specific to their sector and should take into account the local context, existing policies and regulations, and the needs and priorities of different stakeholders.
- Invite groups to share their findings and discuss commonalities and differences across sectors. Facilitate a conversation on how these measures could be integrated and coordinated across sectors to ensure a holistic and effective approach to urban risk governance.
- Ask groups to identify the key stakeholders and actors that would need to be involved in implementing their proposed measures. These could include government agencies, private sector partners, civil society organizations, community groups, and residents.
- Have each group draft a short institutional mechanism or framework that outlines the roles, responsibilities, and coordination mechanisms among different stakeholders. This could include a visual diagram or flowchart that illustrates the different components of the mechanism.
- Invite groups to present their institutional mechanisms to the whole group, and facilitate a discussion on the strengths and weaknesses of each approach. Encourage learners to identify areas of alignment and potential trade-offs, and to reflect on the feasibility and sustainability of the proposed mechanisms
- As the last step ask 2 team members from each group to come and collectively develop an entire framework based on their themes

**Session Plan**

| Content | Trainer's Note | Time |
|---|---|---|
| Introduction to the scenario and instructions | The trainer should explain the scenario based on the issue raised, and give proper instructions on how to carry out the practice | 5 min |
| Brainstorming by groups and discussion of findings | The trainer should focus on generating an insightful discussion and should help in their guidance | 15 min |
| Final Mechanisms and key takeaways | The trainer should focus on getting key takeaways from the learners as a part of the exercise | 10 min |

**Reference**

Al Jazeera. (2021). *Cyclone Tauktae makes landfall in India's s Gujarat* https://www.aljazeera.com/news/2021/5/17/cyclone-tauktae-makes-landfall-in-indias-gujarat

# Notes

# Learning Unit 5.4: Field Visit

## Brief Description of the Learning Unit

The field visit is an experiential learning opportunity that involves visiting a city or urban community to observe and understand their urban resilience strategies, policies, and governance frameworks. Learners can interact with local stakeholders, government officials, community members, and experts during their visit to gain insights into how resilience is conceptualized, planned, and implemented at the local level. The field visit allows learners to apply their theoretical knowledge of urban resilience to real-world situations, analyze the challenges and opportunities in the local context, and develop a deeper understanding of the role of governance in building resilient cities. Learners can improve their critical thinking, problem-solving, while also helping to build a more sustainable and resilient future through this immersive learning opportunity.

## Learning Objectives

- To identify the city's main resilience challenges and assess the efficacy of existing resilience strategies and initiatives in addressing those challenges.
- To investigate the role of various stakeholders in promoting urban resilience, such as government agencies, non-governmental organizations, community groups, and private sector actors, and to comprehend how they collaborate and coordinate their efforts to achieve resilience.

**Duration:** 120 minutes

## Methodology

- Field visit
- Discussions

## Detailed Description

A field visit for urban resilience and governance is an important component of the learning unit, providing learners with the opportunity to explore resilience strategies in practice. It aims to provide learners a first-hand experience of the urban resilience challenges faced by a specific city or community, and the strategies and interventions implemented to address them. The field trip consists of learners including engineers, urban planners, and municipal officials.

During the field trip, the following actions may be taken:

Planning: To ensure that learners get the most out of the experience, the visit should be meticulously planned. Identifying the specific site or community to visit, coordinating with local stakeholders, and developing a detailed itinerary may be required.

Orientation: Learners should be given an orientation on the context of the city or community they will be visiting, including its history, geography, and socioeconomic characteristics, before their visit. This will help learners understand the city's/ community's specific challenges and the interventions put in place to address them.

Site visit: Depending on the learning goals, the site visit may include a variety of activities. Learners may, for example, visit community-based organizations, government agencies, or infrastructure projects that show resilience strategies in action. Interactions with local stakeholders may also be conducted during the visit to better understand their perspectives on resilience challenges and interventions.

Debriefing and reflection: Following the visit, learners should be able to reflect on their experiences and debrief with their peers and instructors. Group discussions, written reflections, or presentations may be used. Learners should be encouraged to critically analyze the resilience strategies they observed and consider how they might be applied in different contexts.

**Session Plan**

| Content | Trainer's Note | Time |
|---|---|---|
| Debriefing the Field Visit | The trainer should explain the scenario based on the site and give proper instructions on how to carry out the practice, before the journey | 10 min |
| Field Visit | The trainer should focus on generating an insightful discussion and should help in their guidance | 90 min |
| Debriefing and reflection | The trainer should focus on getting key takeaways from the learners as a part of the exercise | 20 min |

# Notes

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## Summary

The Technical Session 5 guides the learners on:

- How to mainstream DRR and CCA into existing policies, practices, and government interventions for a holistic development
- Sectoral expertise that can contribute to minimizing risks and enhancing resilience through the use of technologies, cooperation, nature-based solutions, etc
- Existing policies and programmes like SAPCC, NAP, etc. and their take on building resilience
- Drafting an institutional mechanism to promote DRR and CCA
- Role of various stakeholders in promoting urban resilience through interactions and field visits

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**BUILDING RESILIENCE**