

### 4.2.2 Challenges

- Cities are increasingly vulnerable to:

- disease epidemics
- criminal activity
- loss of housing affordability
- natural disasters
- Social dysfunction (e.g. rioting)
- increased airborne particulates (e.g. due to wildfires)
- flooding & drought
- increases in storm intensity
- higher sea level rise → salinization of soil, aquifers & loss of underground infrastructure
- decreases in agricultural productivity due to loss of ecosystem services

### 4.2.3 Resilience

#### ► Resilience

- Capacity of individuals, communities, institutions, businesses & systems within an urban environment to survive, adapt, and grow no matter the stresses or shocks experienced.
- involves development of an integrated plan to address those challenges

#### ► Resilience Theory

- Resilient systems have specific qualities
- For overall resiliency to be achieved, the sub-systems within a city need to have these qualities
- Some qualities:
  - Reflective
  - Robust
  - Resourceful
  - Redundant
  - Flexible
  - Inclusive
  - Integrated

Ex. of infrastructure intervention:  
Replace old infrastructure in such a way to enhance or improve more than one infrastructure system  
An engineer should seek to find interdependences between built systems.

#### ► The City Resilience Framework (CRF)

- a way of understanding the complexity of cities & the drivers that contribute to their resilience
- helps assess extent of a city's resilience, identify areas of weakness, design for improvements

#### • Four Essential Dimensions of Urban Resilience

- 1) Health and Wellbeing
- 2) Economy and Society
- 3) Infrastructure and Environment
- 4) Leadership and Strategy

#### 4.2.4 The City Resilience Framework (CRF)

1) Health and Wellbeing: Everyone living & working in the city has access to what they need to survive and thrive

- Meets Basic Needs

- > particularly in times of crisis

- > e.g. food, water, shelter, sanitation

- Supports Livelihoods and Employment

- > assist individuals to access diverse livelihood & employment opportunities

- > e.g. access to business investment and social welfare, skills training, fair labour policy, innovation

- Ensures Public Health Services

- > to safeguard physical and mental health

2) Economy and Society: The social and financial systems that enable urban populations to live peacefully and act collectively

- Promote Cohesive and Engaged Communities

- > create a sense of collective identity and mutual support

- > e.g. building sense of local identity, social networks, encouraging cultural diversity, promoting tolerance

- Ensure Social Stability, Security, and Justice

- > ensuring a comprehensive and inclusive approach to law enforcement and justice

- > e.g. fair & transparent policing, enforcement of laws

- Foster Economic Prosperity

- > ensuring availability of funding and a vibrant economy as a result of diverse revenue streams, ability to attract business investments, and contingency plans

- > involves good governance, integration with regional & global economy, and measures to attract investment

3) Leadership and Strategy: The processes that promote effective leadership, inclusive decision-making, empowered stakeholders, and integrated planning

- Promote Leadership and Effective Management

- > encourage capable leadership and effective urban management within government & civil society

- > involves strong leadership, cross-sector communication, and evidence-based decision making

- Empower a Broad Range of Stakeholders

- > ensure that everyone is well-informed, capable, and involved in their city

- > includes access to information & education, knowledge transfer, monitoring, and communication between government and the public

- Foster Long-Term and Integrated Planning

- > align & coordinate sectoral plans and individual projects with the city's vision

- > includes city strategies & plans

4) Infrastructure and Environment: The human-made and natural systems that provide critical services, protect, and connect urban

assets enabling the flow of goods, services, and knowledge

- Provides ...

assets enabling the flow of goods, services, and knowledge

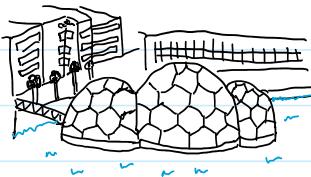
- Provide and Enhance Protective Natural and Human-Made Assets
    - > maintaining the assets to reduce the physical Vulnerability of city systems
    - > includes natural systems (wetlands, mangroves, sand dunes) or built infrastructure (levees, sea walls)
  - Ensure Continuity of Critical Services
    - > managing actively and enhancing natural and human-made resources
    - > includes designing flood-proof physical infrastructure so people can evacuate, ecosystem management for flood risk management
    - > also includes emergency response plans & contingency plans
  - Provide Reliable Communication and Mobility
    - > providing free flow of people, communication, and goods
    - > includes information & communication networks as well as physical movement through a multimodal transport system

## 4.2.5 Rotterdam

- Climate Initiative
    - Adaptation Strategy – Five Primary Themes
      - Flood Management
      - Accessibility for Ships & Passengers
      - Adaptive Buildings
      - Urban Water Systems
      - Quality of Life Within the City

- ## • Urban Water System:

- ## The Floating Pavilion



- > To respond dynamically to the challenges of  
climate change & sea level rise

- Bentengplein Water Square



- > During dry weather, it is a public square
  - > During heavy rainfall, 3 basins retain storm water from the square and retaining rooftops
  - > Adds redundancy

- ## • Dakkkers Green Rooftop

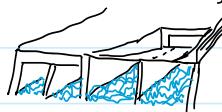


- > Europe's first large scale urban agricultural rooftop



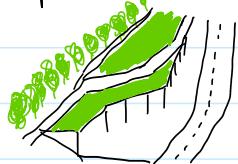
- > Europe's first large scale urban agricultural rooftop
- > Supply vegetables & honey, and collect & retain excess rainwater

- Museum Park Garage



- > When the sewer system threatens to overflow, the hatch of the underground water reservoir opens
- > When downpour is over, rainwater is pumped into sewer

- Dakpark (Roof Park)



- > offers green space for residents and create growth opportunities for local businesses

#### 4.2.6 Resiliency at Different Scales

- Nine planetary boundaries we need to live within
  - Climate Change
  - Ozone Depletion
  - Ocean acidification
  - Global freshwater use
  - Biogeochemical loading: Global N & P Cycles
  - Rate of biodiversity loss
  - Land System change
  - Atmospheric aerosol loading
  - Chemical pollution