SKOLKOVO CENTER FOR URBAN STUDIES

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2017

Urban Resilience: Study of Framework and Key Issues

1. General framework
2. Case studies
3. Urban resilience as seen by international organizations and institutes
4. Cross-cities analysis

1. General framework

- Urban Resilience is the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience. *-100 Resilient Cities*

CHRONIC STRESSES
- high unemployment
- inefficient public transportation system
- endemic violence
- chronic food and water shortages

ACUTE S HOCKS
- floods
- disease outbreaks
- terrorist attacks

- A disaster resilient city can be understood as a city that has managed to
    - (1) reduce or avoid current and future hazards,
    - (2) reduce current and future susceptibility to hazard,
    - (3) establish functioning mechanisms and structures for response to disaster ,
    - (4) establish functioning mechanisms and structures for post-disaster recovery.

Wamstel et al. Business management and accounting, energy, engineering, environmental sciences, 2013

Urban resilience is a city's ability to predict, react and recover from chronic stresses and acute shocks. It is a governing principle that incorporates characteristics, chosen by each city individually.

	CHRONIC STRESSES	ACUTE SHOCKS
Environmental	Water scarcity, poor air quality, food insecurity, environmental degradation, rising sea level and erosion	Earthquakes, floods, wildfires, sandstorms, extreme cold, heat wave, tsunami, blizzards, epidemic
Anthropogenic	Emissions	Hazardous materials accident Infrastructure or building failure
Political	Changing demographics Economic and social inequality Political instability	Riot/civil unrest
Economic	High unemployment, ageing infrastructure, shifting macroeconomic trends, commodities prices fluctuation, dependence on one sector of the economy	Financial collapse
Social	Overtaxed or inefficient public transportation system, endemic violence, chronic food and water shortages, lack of affordable housing, homelessness, lack of social cohesion, crime & violence, mobility and transportation access, overpopulation, refugees, poverty, lack of medical facilities and infrastructure	Terrorism Disease outbreak Cyber attack

- Resilio, resilire, resilui- (Latin) - 'to spring back'
- Was first used by **physical scientists**
- 1960s - resilience entered the field of **ecology**
- Holling, C.S. (**1973**) 'Resilience - the persistence of relationships within a system and is a measure of the ability of these systems to absorb change of state variable, driving variables, and parameters, and still persist'
- Perrings (**1998**) 'Resilience - a measure of the ability of a system to withstand stresses and shocks—its ability to persist in an uncertain world'
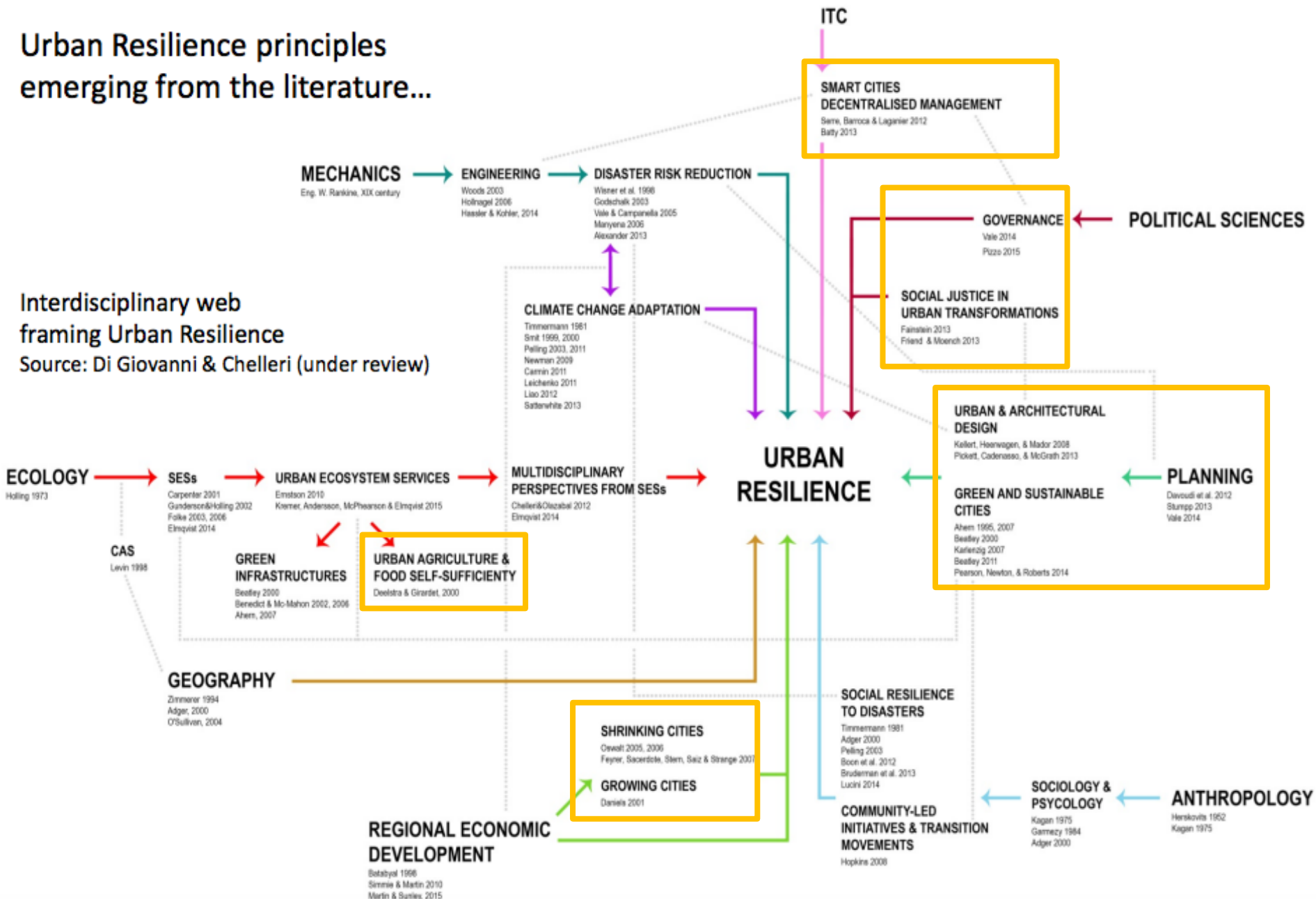
- **Hyogo Framework for Action 2005-2015**: Building the Resilience of Nations and Communities to Disasters, UNISDR. One of the three strategic goals is Development and strengthening of institutions, mechanisms and capacities to build resilience to hazards
- **Sendai Framework for Disaster Risk Reduction 2015−2030**, adopted by UN Member States in 2015 at the World Conference on Disaster Risk Reduction held in Sendai, Japan;
- **UN Sustainable Development Goals, 2015. Goal 11** - to Make(ing) cites and human settlements inclusive, safe, resilient and sustainable
- **Conference of Parties (COP21), 2015 , Paris.** - UN Framework Convention on Climate Change - a universal agreement on climate change adaptation.
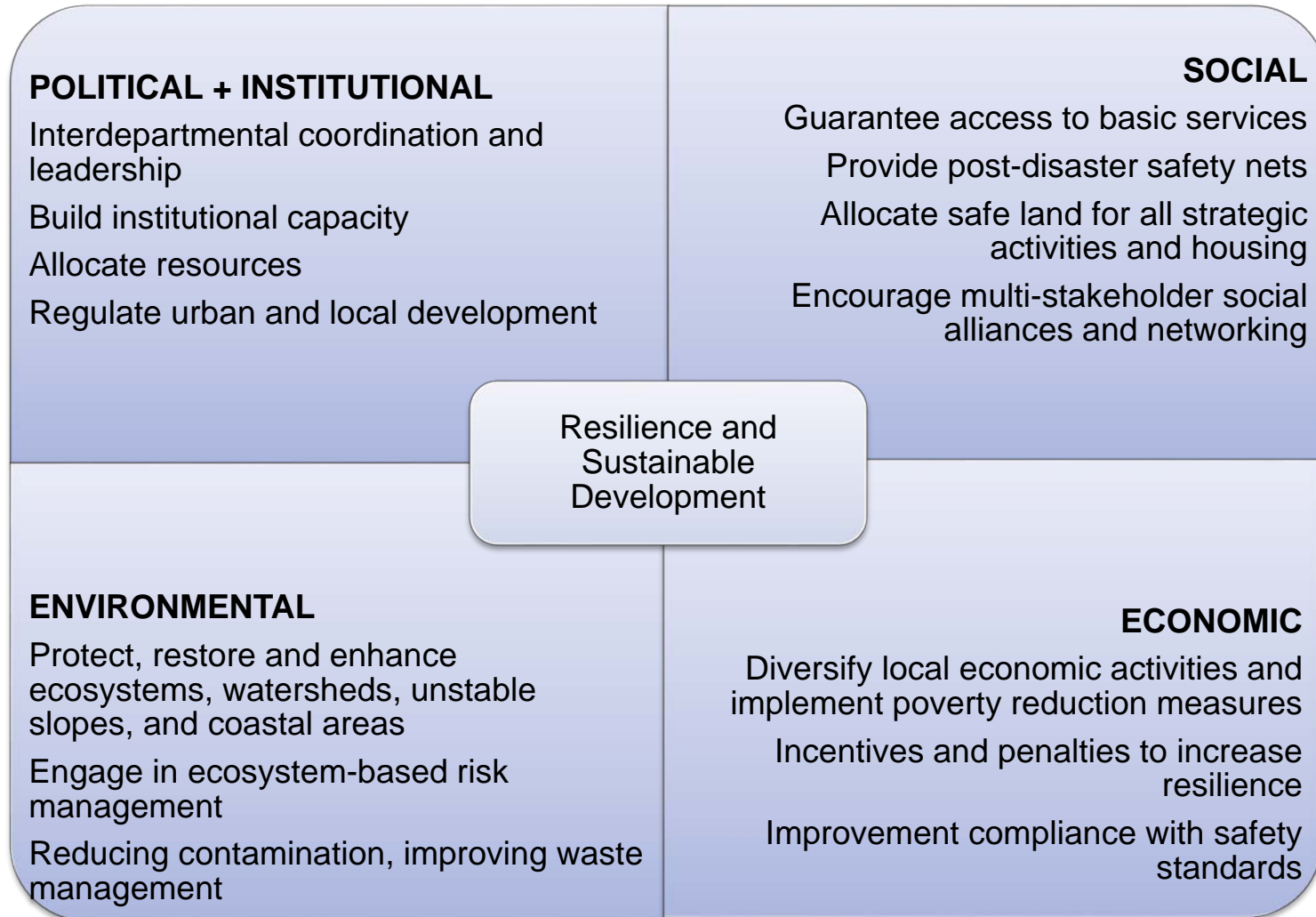
Urban resilience and other sciences

Urban Resilience principles emerging from the literature...

Interdisciplinary web framing Urban Resilience
Source: Di Giovanni & Chelleri (under review)

ITC

SMART CITIES DECENTRALISED MANAGEMENT
Serre, Barroca & Laganier 2012
Batty 2013

MECHANICS → **ENGINEERING** → **DISASTER RISK REDUCTION**
Eng. W. Rankine, XIX century

Woods 2003
Hollnagel 2006
Hassler & Kohler, 2014

Wisner et al. 1998
Godschalk 2003
Vale & Campanella 2005
Manyena 2006
Alexander 2013

GOVERNANCE ← **POLITICAL SCIENCES**
Vale 2014
Pizzo 2015

SOCIAL JUSTICE IN URBAN TRANSFORMATIONS
Fainstein 2013
Friend & Moench 2013

CLIMATE CHANGE ADAPTATION
Timmermann 1981
Smit 1999, 2000
Pelling 2003, 2011
Newman 2009
Carmin 2011
Leichenko 2011
Liao 2012
Satterwhite 2013

URBAN & ARCHITECTURAL DESIGN
Kellert, Heerwagen, & Mador 2008
Pickett, Cadenasso, & McGrath 2013

ECOLOGY → **SESs** → **URBAN ECOSYSTEM SERVICES** → **MULTIDISCIPLINARY PERSPECTIVES FROM SESs** → **URBAN RESILIENCE**
Holling 1973

Carpenter 2001
Gunderson&Holling 2002
Folke 2003, 2006
Elmqvist 2014

Emstson 2010
Kremer, Andersson, McPhearson & Elmqvist 2015

Chelleri&Olazabal 2012
Elmqvist 2014

CAS
Levin 1998

GREEN INFRASTRUCTURES
Beatley 2000
Benedict & Mc-Mahon 2002, 2006
Ahern, 2007

URBAN AGRICULTURE & FOOD SELF-SUFFICIENTY
Deelstra & Girardet, 2000

GREEN AND SUSTAINABLE CITIES
Ahern 1995, 2007
Beatley 2000
Karlenzig 2007
Beatley 2011
Pearson, Newton, & Roberts 2014

PLANNING
Davoudi et al. 2012
Stumpp 2013
Vale 2014

GEOGRAPHY
Zimmerer 1994
Adger, 2000
O'Sullivan, 2004

SOCIAL RESILIENCE TO DISASTERS
Timmermann 1981
Adger 2000
Pelling 2003
Boon et al. 2012
Bruderman et al. 2013
Lucini 2014

SHRINKING CITIES
Oswalt 2005, 2006
Feyrer, Sacerdote, Stern, Saiz & Strange 2007

GROWING CITIES
Daniels 2001

SOCIOLOGY & PSYCOLOGY
Kagan 1975
Garmezy 1984
Adger 2000

ANTHROPOLOGY
Herskovits 1952
Kagan 1975

COMMUNITY-LED INITIATIVES & TRANSITION MOVEMENTS
Hopkins 2008

REGIONAL ECONOMIC DEVELOPMENT
Batabyal 1998
Simmie & Martin 2010
Martin & Sunley 2015

Different perspectives on urban resilience

POLITICAL + INSTITUTIONAL

Interdepartmental coordination and leadership

Build institutional capacity

Allocate resources

Regulate urban and local development

SOCIAL

Guarantee access to basic services

Provide post-disaster safety nets

Allocate safe land for all strategic activities and housing

Encourage multi-stakeholder social alliances and networking

Resilience and Sustainable Development

ENVIRONMENTAL

Protect, restore and enhance ecosystems, watersheds, unstable slopes, and coastal areas

Engage in ecosystem-based risk management

Reducing contamination, improving waste management

ECONOMIC

Diversify local economic activities and implement poverty reduction measures

Incentives and penalties to increase resilience

Improvement compliance with safety standards

Leadership & Strategy = KNOWLEDGE

- Promote Leadership and Effective Management
- Empower a Broad Range of Stakeholders
- Foster Long-Term and Integrated Planning

Health & Wellbeing = PEOPLE

- Meets Basic Needs
- Supports Livelihoods and Employment
- Ensures Public Health Services

Economy & Society = ORGANIZATION

- Promote Cohesive and Engaged Communities
- Ensure Social Stability, Security, and Justice
- Foster Economic Prosperity

Infrastructure & Environment = PLACE

- Provide and Enhances Protective Natural and Man-Made Assets
- Ensure Continuity of Critical Services
- Provide Reliable Communication and Mobility
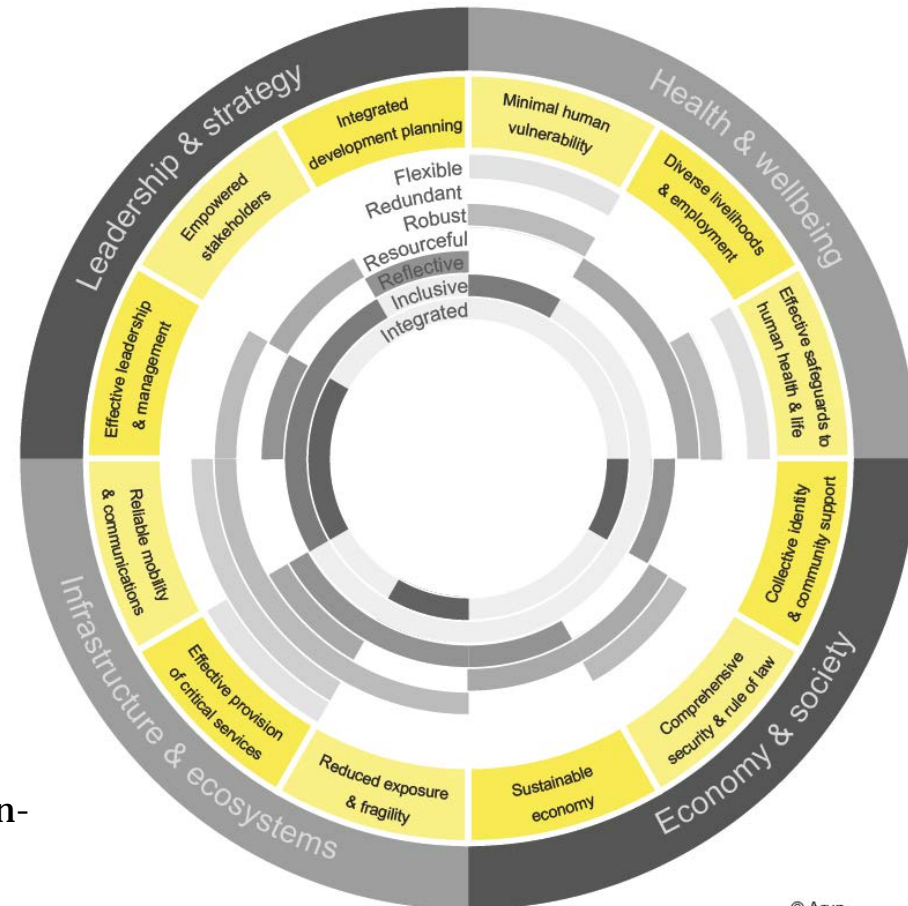
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- **National government**
- **Local government**
- **Local team** (London Resilience Team, Barcelona Urban Resilience Partnership)
- **Urban services** (companies responsible for waste collection, urban cleaning, green zones, water management, environmental constructions)
- **Private sector/business community:** (utility provision & management, construction, engineering management, consulting, computing, retail)
- **Citizens, community groups**
- **Global Organizations** (UN Habitat, UN International Strategy for Disaster Reduction, World Bank - Global Facility for Disaster Reduction and Recovery)
- **Global alliances** (The Medellín Collaboration on Urban Resilience, Cities Alliance)
- **International organizations**: (ICLEI, ISOCARP, C40, 100 Resilient Cities Network)
- **Academia, research centers** (MIT Urban Risk Lab, Stanford Urban Resilience Initiative, Warwick, LSE Cities, Oxford Programme for the Future of Cities, UCL Urban Lab, Delft University of Technology, Stockholm Resilience Centre (Stockholm University), Brussels Centre for Urban Studies (Vrije Universiteit Brussel, VUB), IHS International Institute of Urban Management of Erasmus University Rotterdam)

Stages of implementing a resilience strategy

Institutional, political, normative, financial context

Stage	Description
Risk identification	Risk assessments (community-based, probabilistic modeling); risk mapping; information campaigns; public outreach; etc.
Risk reduction	Structural and non-structural measures; land use planning; policies and regulations; infrastructure retrofitting; etc.
Preparedness	Civil protection systems; pre-postitioning emergency response equipment; early warning systems; contingency planning; etc.
Financial protection	Assessing and reducing contingent liabilities; budget appropriation and execution; *ex-ante* and *ex-post* financing instruments; etc.
Resilient recovery	Resilient recovery and reconstruction policies; *ex-ante* design of institutional response mechanisms; etc.

Source: Global Facility for Disaster Reduction and Recovery (GFDRR)

Safe city & Resilient city

	Safe city	Resilient City
Key methods	Smart systems and smart solutions, Intelligent security analysis	Emergency management Integrated development planning Effective leadership management Risk assessment Multisystem approach to governance
Focus	Criminality (crime security, jail spaces, homeless encampments, shortened emergency response time, digital crimes) Social issues (drug and alcohol addiction, crowd safety management, domestic violence and abuse, extremism, gender-responsive public services) Additional topics: • Infrastructure safety • Smart meteorology systems • Good governance	Wide range of chokes and stresses (all sectors of life) • Climate risk management • Economic resilience • Social stability & security • Walkability & accessibility, transit & mobility • Empowered stakeholders • Cultural resilience • Health resilience • Collective identity & mutual support • Water & waste management • Protection of biodiversity

Lack of accepted differentiation

Sustainability is the capacity for:

- Human health and well being
- Economic vitality and prosperity
- Environmental resource abundance

continuity

fitness

Resilience is the capacity to:

- Overcome unexpected problems
- Adapt to change (e.g., sea level rise)
- Prepare for and survive catastrophes

Source: US Environmental protection agency
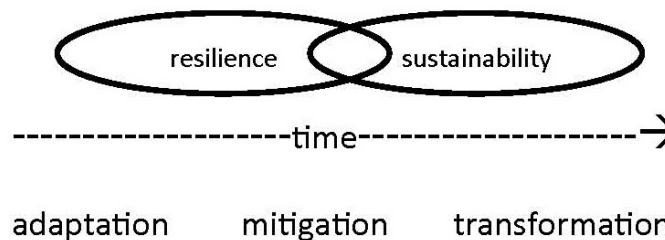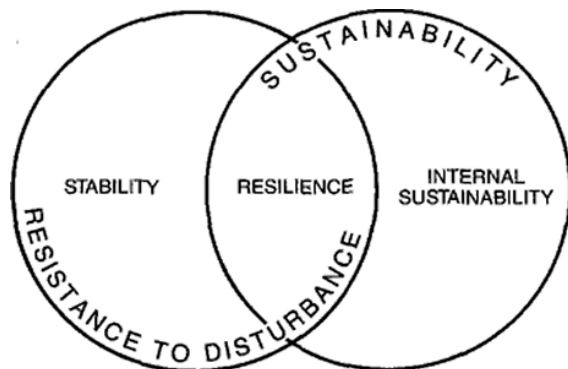
Urban form resilience: key principles

1. Urban form should be designed to be able to accommodate lower and higher population densities who are able to create the need for services and amenities concentrated in the same location, as well as demand for mixed transport options.

2. Urban form should be designed at levels of land coverage sufficient to achieve high population density but without eroding the resources and adaptability of the public realm.

3. Design for future adaptability:

   a. Streets should be laid out in a porous, simple arrangement incorporating a loosely defined hierarchy of generously proportioned major and minor routes.

   b. Building structures should be designed to enable internal layouts to be configured quite differently, without the need to undermine structural integrity or invest large sums in reconstruction.

4. Green and other forms of public space infrastructure should be designed at the outset of development, alongside strategies for managing this as a public resource over time.

5. Urban form should be designed with an evolving topography of mixed uses and tenures in mind, which may be distributed vertically and horizontally through buildings and across neighbourhoods.

Building Regulations and Land Use Planning

LSE Cities - Exploring the relations between urban form resilience and the governance of urban form

Delft University of Technology - Spatial planning and urban resilience in the context of flood risk

Measuring four dimensions of resilient urban form: frame of the challenge

Physical	Density	Population density per hectare (Maps) Coverage and floor area ratio (Maps
	Street layout and building types	Street and building sections (Illustrations) - Building floor plans (Illustrations)
Environmental	Public transport accessibility	Public transport stations (Maps)
	Green space	Green space coverage (Maps)
Social	Land use and social amenities	Ground floor use (Maps) - Section use (Illustrations) - Social amenities (Maps)
	Tenure	Housing tenure statistics (Statistics)
Economic	Property values over time	House prices since 1990 (Statistics) Historical prices (Archival research)
	Property values in urban context	House price heat maps across the city (Maps)

2. Case studies: London and Barcelona

London Resilience Team - **multi-agency cooperation in planning for, and responding to large scale emergencies.**

- Created in 2002 as a part of the **Government Office for London**.

- In 2010 the London Resilience Team transferred from the Government Office for London to the **Greater London Authority**. In February 2015 it transferred to **London Fire Brigade** where the team work alongside the Operational Resilience Unit and Emergency Planning Team.

- The team included **170 organisations** from different sectors, including:
  - Greater London Authority
  - Emergency services
  - Government Agencies
  - Local authorities
  - Utilities
  - Transport
  - Health Bodies

Resilient' city - the ability of London to detect, prevent and if necessary to withstand, handle and recover from disruptive challenges (UK Civil Protection Lexicon)

RESILIENCE CHALLENGES

ENDEMIC CRIME AND VIOLENCE

INFRASTRUCTURE FAILURE

LACK OF AFFORDABLE HOUSING

TERRORISM

London Resilience Partnership has experienced a range of emergencies, including severe weather, volcanic ash, flooding and the terrorist attacks of 7 July 2005. + Olympic Game 2012

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Activities:

- Planning for emergencies
- Preparing your business
- Preparing yourself
- Potential risks to London
- London resilience forum

Emergency:
(1) an event or situation which threatens serious damage to human welfare or to the environment;
(2) war or terrorism which threatens serious damage to security
Civil Contingencies Act (2004)

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London's emergency plans

- a single agreed set of procedures across different agencies

- the process of emergency planning also helps understand the impact on routine services, and allows organizations to plan accordingly

Generic emergency plans

to be used irrespective of the type of incident that has occurred:

- Strategic Coordination Protocol - this sets out how all emergency responders work together in the event of an emergency in London

- London Emergency Services Liaison Panel Manual - provides information on the multi-agency initial response, aligned with the Joint Emergency Services Interoperability Principles

- Communicating with the Public Framework — summarizes how we'll communicate with the public before, during and after an emergency

- London Recovery Management Protocol - outlines how the recovery from a major emergency is coordinated

- London Voluntary Sector Capabilities Document - provides information on the services available from pan-London voluntary organizations, which can support the response

Specific emergency

response to individual types of risk. For example, not all emergencies involve flooding, so we have a separate framework setting out the response to that risk.

All of the specific plans are designed to complement the generic plans, and can be simultaneously activated. For example, it might be necessary to undertake an evacuation during an adverse weather event, in which case multiple emergency plans would be activated.

- London Strategic Flood Response Framework - information for local responders to assist in decision making and planning for a flood incident
- London Pandemic Influenza Framework - response to an outbreak of pandemic flu
- London Humanitarian Assistance Plan – planned support for those affected by emergencies
- London Mass Casualty Framework – response arrangements in the event of an incident involving many casualties
- London Mass Fatality Framework – how London will respond to an incident involving a significant number of deaths in a short space of time
- London Excess Deaths Framework - response to a large number of deaths over an extended period of time, for instance as a result of disease
- London Structural Collapse Response and Recovery Framework - guidance for planning for and responding to a large scale structural collapse
- London Adverse Weather Framework - actions to be taken in the case of heatwaves, snow and other adverse weather
- London Mass Evacuation Framework – guidance for managing a mass evacuation of displaced persons

Barcelona Urban Resilience Partnership

High stakeholder engagement and cross-departmental working groups
Barcelona Resilience Department is built on:
- Urban Habitat's Operation Centre (UN-Habitat's City Resilience Profiling Programme),
- Infrastructure Urban Resilience Boards
- Situation Room (information platform to support decision making for risk reduction)

Public-private alliance:
- 13 companies and
- high-level research centers
- Barcelona City Council

Main activities
- Resilience governance
- Protection of critical infrastructures
- Planning Urban Resilience
- Managing Urban Risk

RESILIENCE CHALLENGES

COASTAL FLOODING

HEAT WAVE

HIGH UNEMPLOYMENT

LACK OF AFFORDABLE HOUSING

RAINFALL FLOODING

SOCIAL INEQUITY

Partnership areas
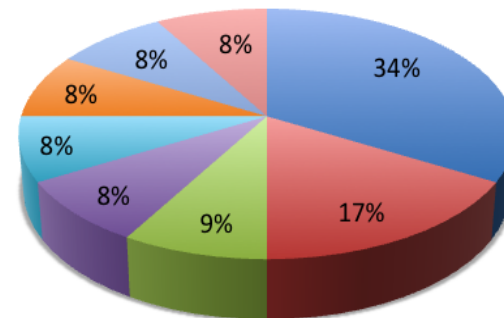
- 34% Urban services
- 17% Engineering consulting
- 9% Computing services
- 8% Private foundation
- 8% Research organisation
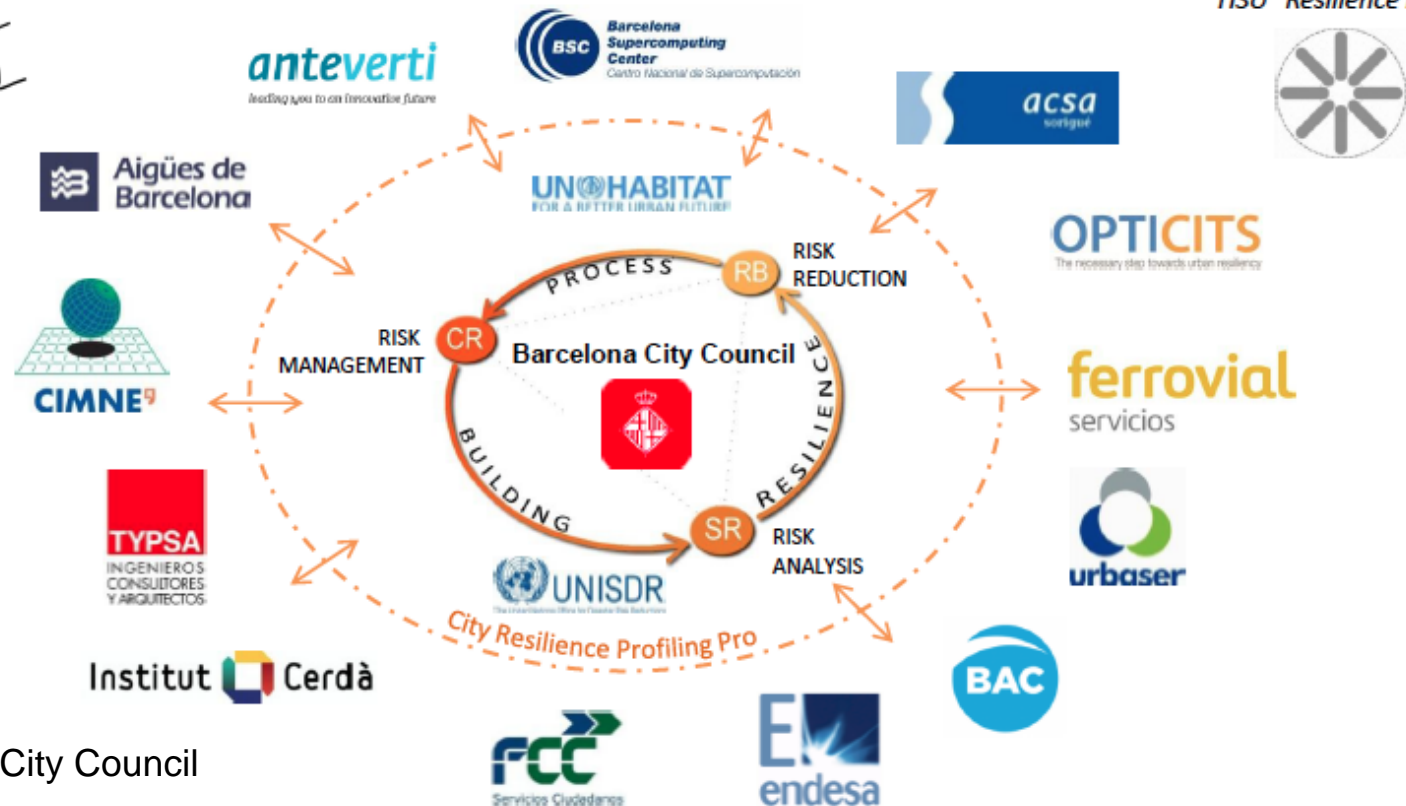- 8% Construction
- 8% Utility
- 8% General consulting

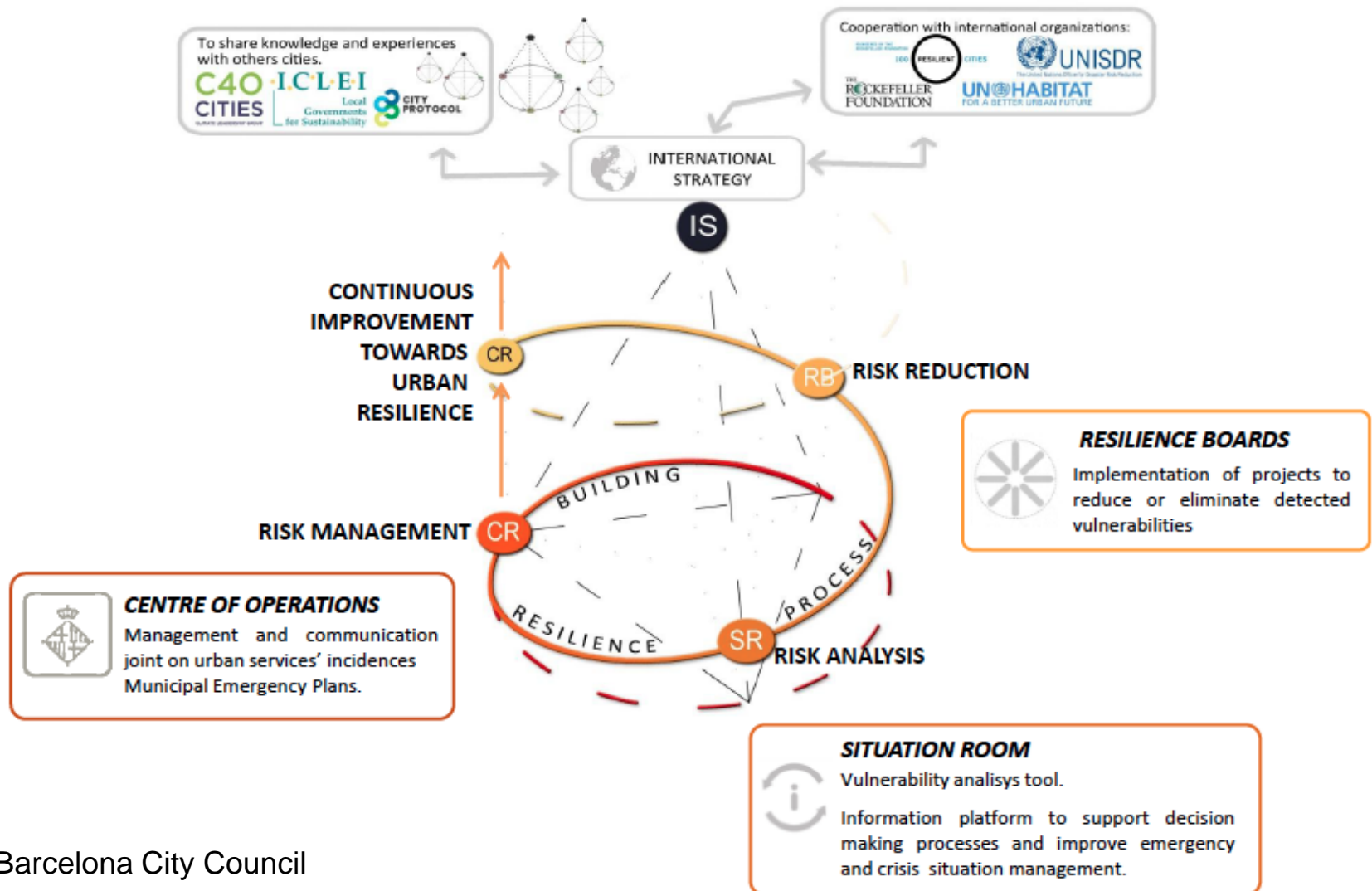# CREATION OF THE BARCELONA URBAN RESILIENCE PARTNERSHIP

Source: Barcelona City Council

Urban Resilience Governance Structure in Barcelona

URBAN RESILIENCE DEPARTMENT'S STRUCTURE

Source: Barcelona City Council

3. Urban resilience as seen by international organizations and institutes

LSE Cities: Governance resilient principles

1. Long-term perspectives are crucial. These may include:

   a. New forms of long-term land ownership, including mechanisms for establishing community and state ownership and enabling these bodies to create new great (public) 'estates' and generate returns for future society rather than individuals as 'heirs'.

   b. Planning for anticipated and as yet unknown or unknowable forms of growth and change - developing strategies for planning for uncertainty.

   c. Developing financial mechanisms to enable upfront investment in public infrastructure for the long-term in order to overcome the risks associated with urban value creation.

2. Detailed planning at the urban scale to create a balance between private and public interests and between short and long-term profits.

3. Develop principals of stewardship which relate to the long-term management of uses, the preservation of amenities, natural resources and diverse populations.

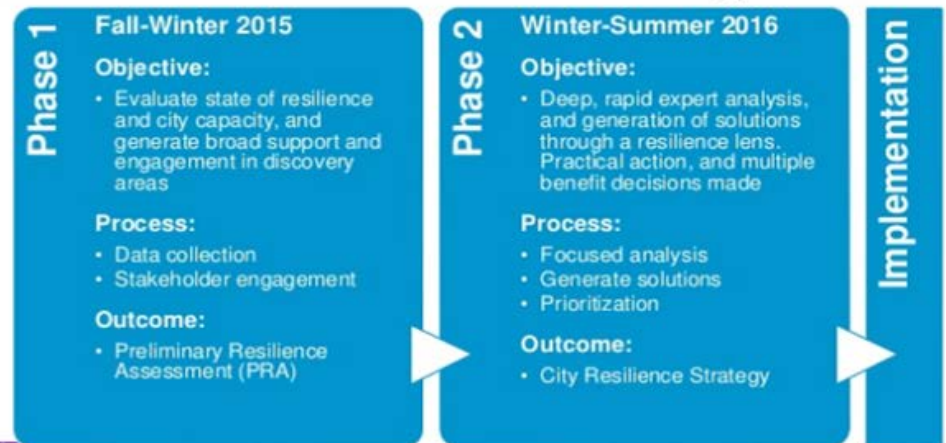# UN International Strategy for Disaster Reduction
Bringing resilience to governance

1. **Organization and coordination**.
2. Assign a **budget**
3. Maintain up to date **data**
4. Invest in and maintain **critical infrastructure**
5. Assess the **safety of all schools and health facilities**
6. Building **regulations and land use planning** principles
7. Protect **ecosystems and natural buffers to mitigate floods**
8. Install **early warning systems**
9. **Centre of reconstruction** (support to help implement responses, including rebuilding homes and livelihoods)
10. **Education programs** and training on disaster risk reduction

UNISDR A Handbook for Local Governments

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Roadmap to resilience along 4 main pathways:

- Financial and logistical guidance for establishing an innovative new position in city government, a <u>Chief Resilience Officer</u>, who will lead the city's resilience efforts;

- Expert support for development of a robust <u>resilience strategy</u>;

- Access to <u>solutions, service providers, and partners from the private, public and NGO</u> sectors who can help them develop and implement their resilience strategies;

- Membership of a <u>global network</u> of member cities who can learn from and help each other.

Overview of the 100RC Resilience Strategy Process

Phase 1	**Phase 2**	**Implementation**
Fall-Winter 2015	**Winter-Summer 2016**	
Objective: • Evaluate state of resilience and city capacity, and generate broad support and engagement in discovery areas	**Objective:** • Deep, rapid expert analysis, and generation of solutions through a resilience lens. Practical action, and multiple benefit decisions made	
Process: • Data collection • Stakeholder engagement	**Process:** • Focused analysis • Generate solutions • Prioritization	
Outcome: • Preliminary Resilience Assessment (PRA)	**Outcome:** • City Resilience Strategy	

RAND   PITTSBURGH   100 RESILIENT CITIES

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4. Cross-city analysis and analytical tools

Multi-hazard Risk Assessment

- Self-assessment Index by UNISDR
- Self-assessment Index by ResearchGate authors
- Arup City Resilience Index
- ACCCRN Index (Asian Cities Climate Change Resilience Network)

Arup City Resilience Index

Minimal human vulnerability	1.1 Safe and affordable housing 1.2 Adequate affordable energy supply 1.3 Inclusive access to safe drinking water 1.4 Effective sanitation 1.5 Sufficient affordable food supply
Diverse livelihood and employment	2.1 Inclusive labour policies 2.2 Relevant skills and training 2.3 Dynamic local business development and innovation 2.4 Supportive financing mechanisms 2.5 Diverse protection of livelihoods following a shock
Effective safeguards to human health and life	3.1 Robust public health systems 3.2 Adequate access to quality healthcare 3.3 Emergency medical care 3.4 Effective emergency response services
Collective identity & community support	4.1 Local community support 4.2 Cohesive communities 4.3 Strong city-wide identity and culture 4.4 Actively engaged citizens
Comprehensive security and rule of law	5.1 Effective systems to deter crime 5.2 Proactive corruption prevention 5.3 Competent policing 5.4 Accessible criminal and civil justice
Sustainable economy	6.1 Well-managed public finances 6.2 Comprehensive business continuity planning 6.3 Diverse economic base 6.4 Attractive business environment

Arup City Resilience Index

Reduced exposure & fragility	7.1 Comprehensive hazard and exposure mapping 7.2 Appropriate codes, standards and enforcement 7.3 Effectively managed protective ecosystems 7.4 Robust protective infrastructure
Effective provision of critical services	8.1 Effective stewardship of ecosystems 8.2 Flexible infrastructure services 8.3. Retained spare capacity 8.4 Diligent maintenance and continuity 8.5 Adequate continuity for critical assets and services
Reliable mobility and communications	9.1 Diverse and affordable transport networks 9.2 Effective transport operation & maintenance 9.3 Reliable communications technology 9.4 Secure technology networks
Effective leadership and management	10.1 Appropriate government decision-making 10.2 Effective co-ordination with other government bodies 10.3 Proactive multi-stakeholder collaboration 10.4 Comprehensive hazard monitoring and risk assessment 10.5 Comprehensive government emergency management
Empowered stakeholders	11.1 Adequate education for all 11.2 Widespread community awareness and preparedness 11.3 Effective mechanisms for communities to engage with government
Integrated development planning	12.1 Comprehensive city monitoring and data management 12.2 Consultative planning process 12.3 Appropriate land use and zoning 12.4 Robust planning approval process

UNISDR Self-assessment tool

An operational framework of Sendai Framework at local level.

Ten Essentials, UNISDR Handbook

ESSENTIAL 1: Put in place organization and coordination to clarify everyone's roles and responsibilities

ESSENTIAL 2: Assign a budget and provide incentives for homeowners, low-income families and the private sector to invest in risk reduction

ESSENTIAL 3: Update data on hazards and vulnerabilities, prepare and share risk assessments

ESSENTIAL 4: Invest in and maintain risk reducing infrastructure, such as storm drainage

ESSENTIAL 5: Assess the safety of all schools and health facilities and upgrade these as necessary

ESSENTIAL 6: Enforce risk compliant building regulations and land use planning, identify safe land for low-income citizens

ESSENTIAL 7: Ensure education programmes and training on disaster risk reduction are in place in schools and communities

ESSENTIAL 8: Protect ecosystems and natural buffers to mitigate hazards, adapt to climate change

ESSENTIAL 9: Install early warning systems and emergency management capacities

ESSENTIAL 10: Ensure that the needs and participation of the affected population are at the centre of reconstruction