Future Resilience of the UK Energy System
A common understanding between sectors

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Overview

- Challenges and opportunities across critical infrastructure sectors
- The Resilience Shift: aims and objectives
- City Resilience Framework
- City Water Resilience Framework
- Closing thoughts: Shaping a system-wide energy resilience approach

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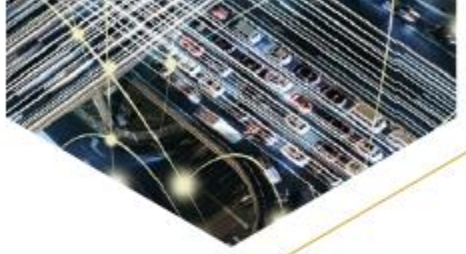

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From: TRB Critical Issues in Transportation 2019

Why Water Resilience?

1 in 4

large cities are already facing water stress

Global water consumption has

doubled every 20 years.

That's twice the rate of population growth.[11]

+55%

Water demand increase by 2050

Lost water through leaks or unbilled usage in 2013:

30%

Average American city

~53%

New Delhi

38%

Most developing nations

Many Pacific Island nations are

less than 5m above sea level

thousands of inhabitants are at risk

By 2030, If efficiency does not improve, worldwide water demand will outstrip supply by[10]

40%

It is estimated that between

1.6 and 2.4 billion

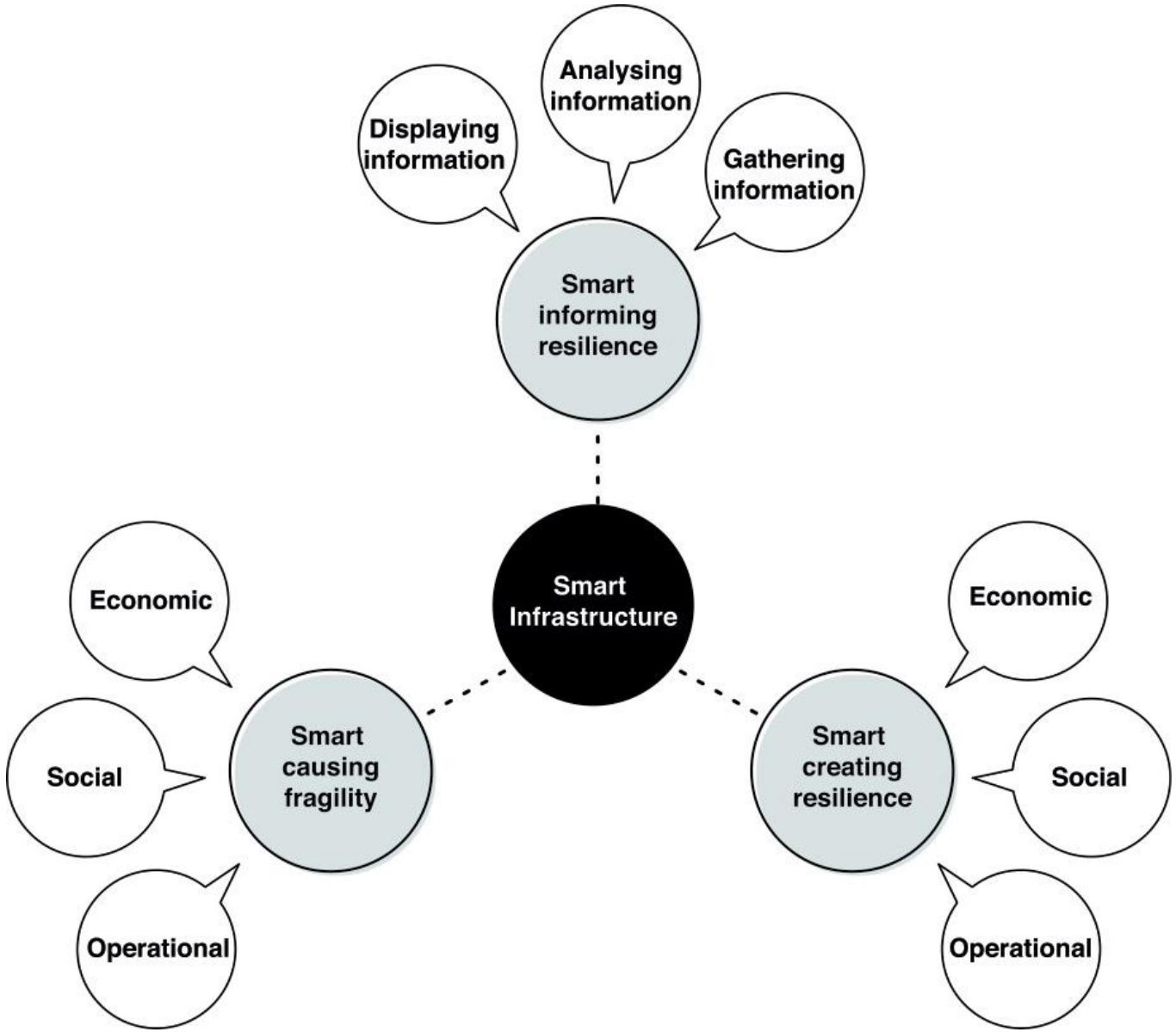
people live in river basins that experience water scarcity.[4]

3.2 million m^3

The amount of water the 100 largest cities in the world transfer approximately 5,700km through artificial channels per day.[2]

Transformative technology

The different ways in which smart infrastructure solutions can impact on the resilience of infrastructure and the people who use and operate it. *(after Cousins et al., 2017)*



Valuing resilience

Efficiency

profit

centralised decision-making

just-in time

lean

reduce waste

productivity

growth

optimisation

Resilience

self-organisation

alternatives

slack

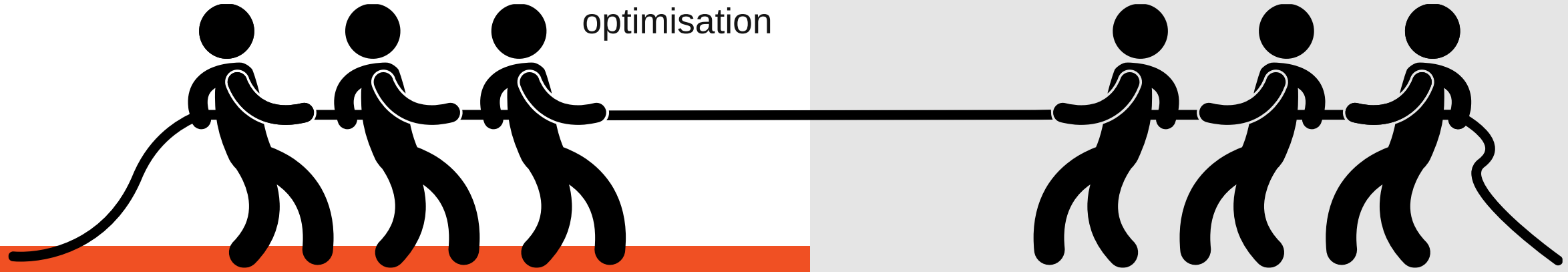
diversity

back-up

adaptability

flexibility

critical functionality



68% of the world's population will live in cities by 2050.

Infrastructure is fundamental to inclusive, safe, resilient and sustainable cities.

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UN Sustainable Development Goals

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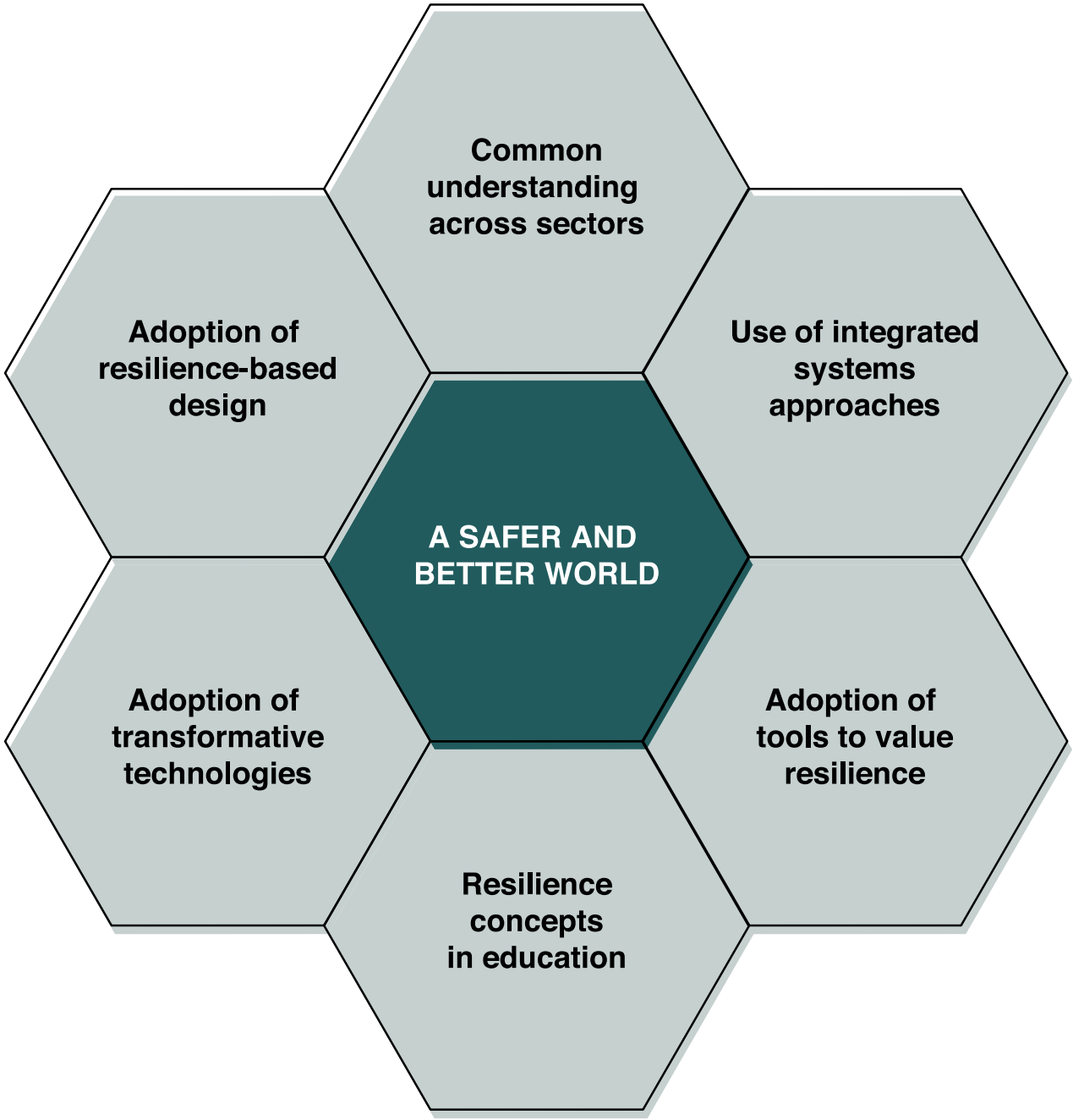
What is the Resilience Shift?

A global initiative to build **resilience** within and between key **critical infrastructure** sectors.

We want to shift how we **plan**, **design**, **deliver** and **operate** critical infrastructure, to make it more resilient, to make sure the public gets the services it expects.

The ultimate benefit of a ‘resilience shift’ will be greater security, and enhanced safety of life, property, and the environment.

If we're successful we will see:



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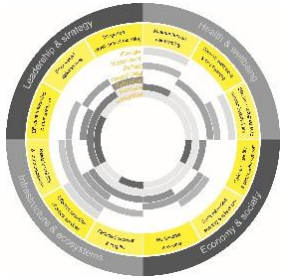
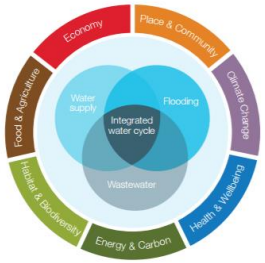
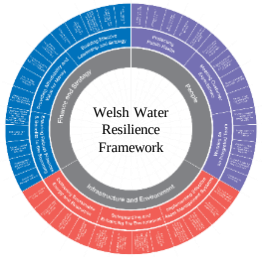
Arup Experience Building Resilience

2012 2013 2014 2015 2016 2017 2018





Unilever
The Future of Urban Water Management



PIONEERED BY THE ROCKEFELLER FOUNDATION
100 RESILIENT CITIES

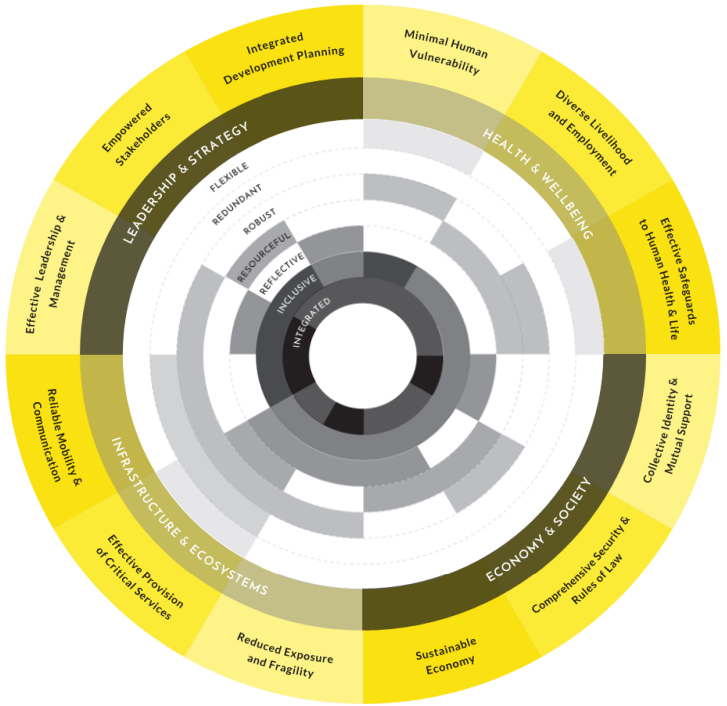
Building on Best Practice
City Water Resilience Index and Framework

- Arup developed the City Resilience Index (CRI) supported by The Rockefeller Foundation, which is the foundation of the 100 Resilient Cities strategy development process.

- Founded on evidence from more than 150 documents, 16 city case studies, primary data collected in 6 cities, consultation in a further 10 cities, and piloting in 5 cities.

- Provides cities with a means to assess and monitor their present day resilience and findings empower cities to identify appropriate actions to strengthen resilience and measure progress over time

- It is currently being implemented by many cities in the 100RC network and Arup is the strategy partner for over 20 cities for the CRI and CRF.



"City resilience describes the capacity of cities to function, so that the people living and working in cities – particularly the poor and vulnerable – survive and thrive no matter what stresses or shocks they encounter"

(City Resilience Index, Arup)

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The Challenge

How can we help cities provide equitable, safe and reliable water resources, and ensure protections in place from water-related shocks and stresses?

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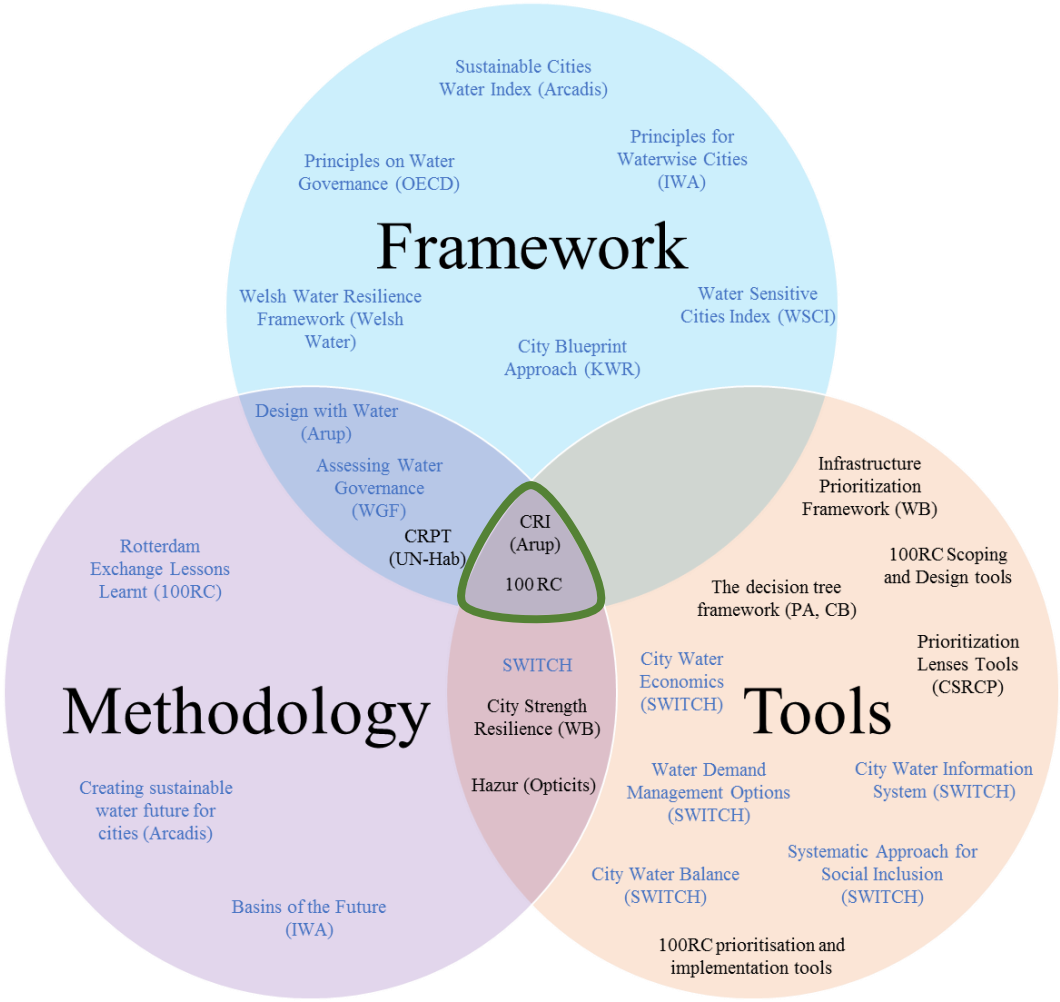
Literature review: Findings

- Governance is a main theme in water and city resilience literature - included in 390 of 750 ‘factors of resilience’.
- Framework needs to result in action. To achieve this, some frameworks include a decision-making or implementation approach.
- Accompanying tools makes some frameworks more accessible and useable.



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Co-Creating the City Water Resilience Approach

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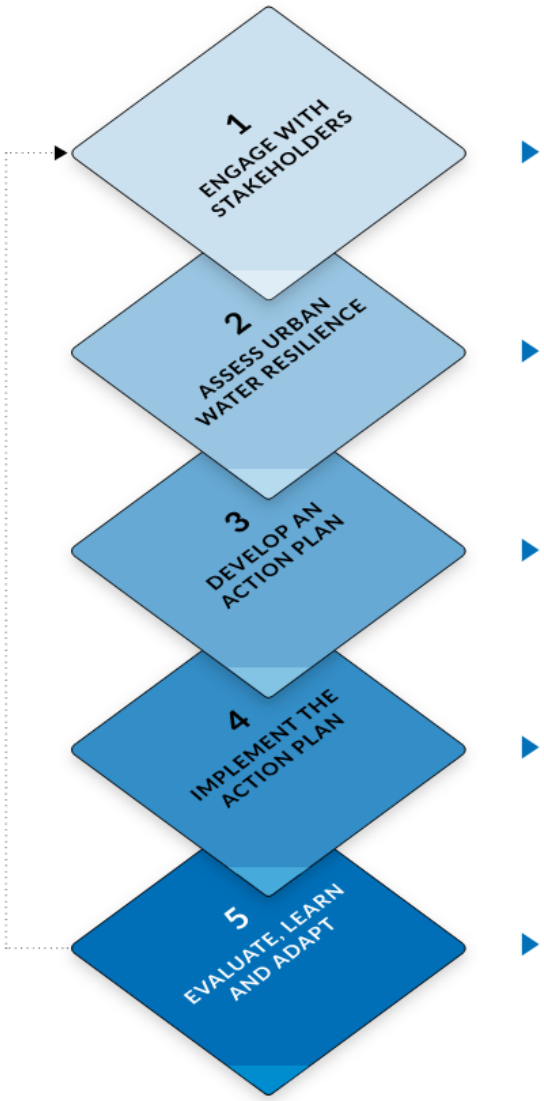
Engaging with City Stakeholders

Fieldwork in eight cities with direct engagement of more than

700 people

City Water Resilience Approach



1. Establish a core team
2. Collect background information
3. Multi-stakeholder inception workshop

Tools:
- Watershare

1. Research data collection
2. Assessment and diagnosis process
3. Findings report
4. Validation workshop

Tools:
- CWRF
- Stakeholder responsibility Matrix

1. Interpretation of results
2. Prioritizing
3. Develop a Joint Action Plan

Tools:
- Governance analysis
- A CWR Action plan Toolbox

1. Develop a M&E mechanism
2. Engage Facilitators and coaches
3. Evaluation of the baseline assessment

Tools:
- A CWR Action plan Toolbox
- Workshop facilitator's guide book

1. Evaluate the implementation of resilience measures
2. Analyse changes in context and stakeholders involvement
3. Re-asses objectives for next period

The City Water Resilience Approach is a multi-step process that moves from stakeholder engagement and city assessment, to creating and implementing action plans, and then monitoring the results of interventions. It has been developed with the goal of helping cities achieve safer and more secure water resources, and protections in place from water-related shocks and stresses.

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City Water Resilience Framework

4 Dimensions

Leadership & Strategy

Planning & Finance

Infrastructure & Ecosystems

Health & Wellbeing

What **objectives** you need to achieve water resilience?

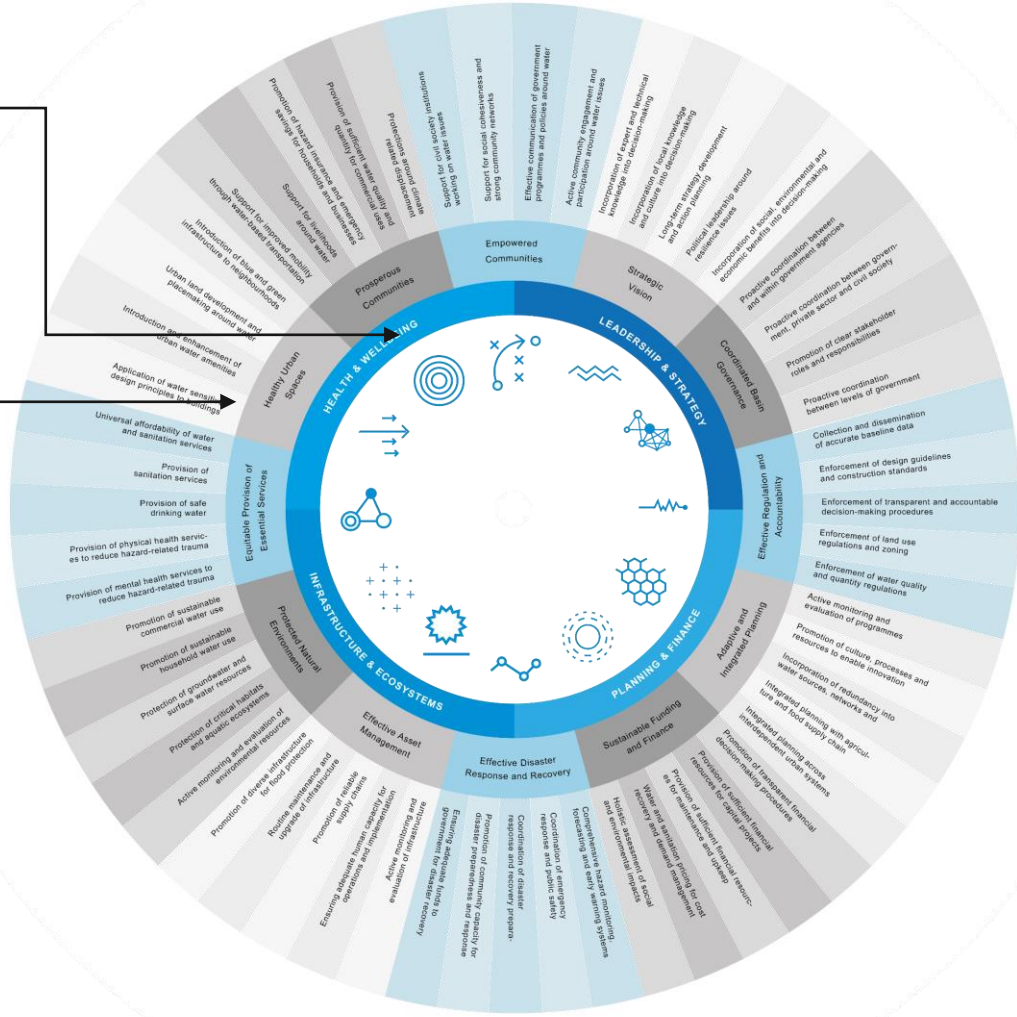
12 Goals

Which **factors** should you observe ?

52 Sub-Goals

Qualitative Indicators

Quantitative Indicators



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A Collaborative Approach

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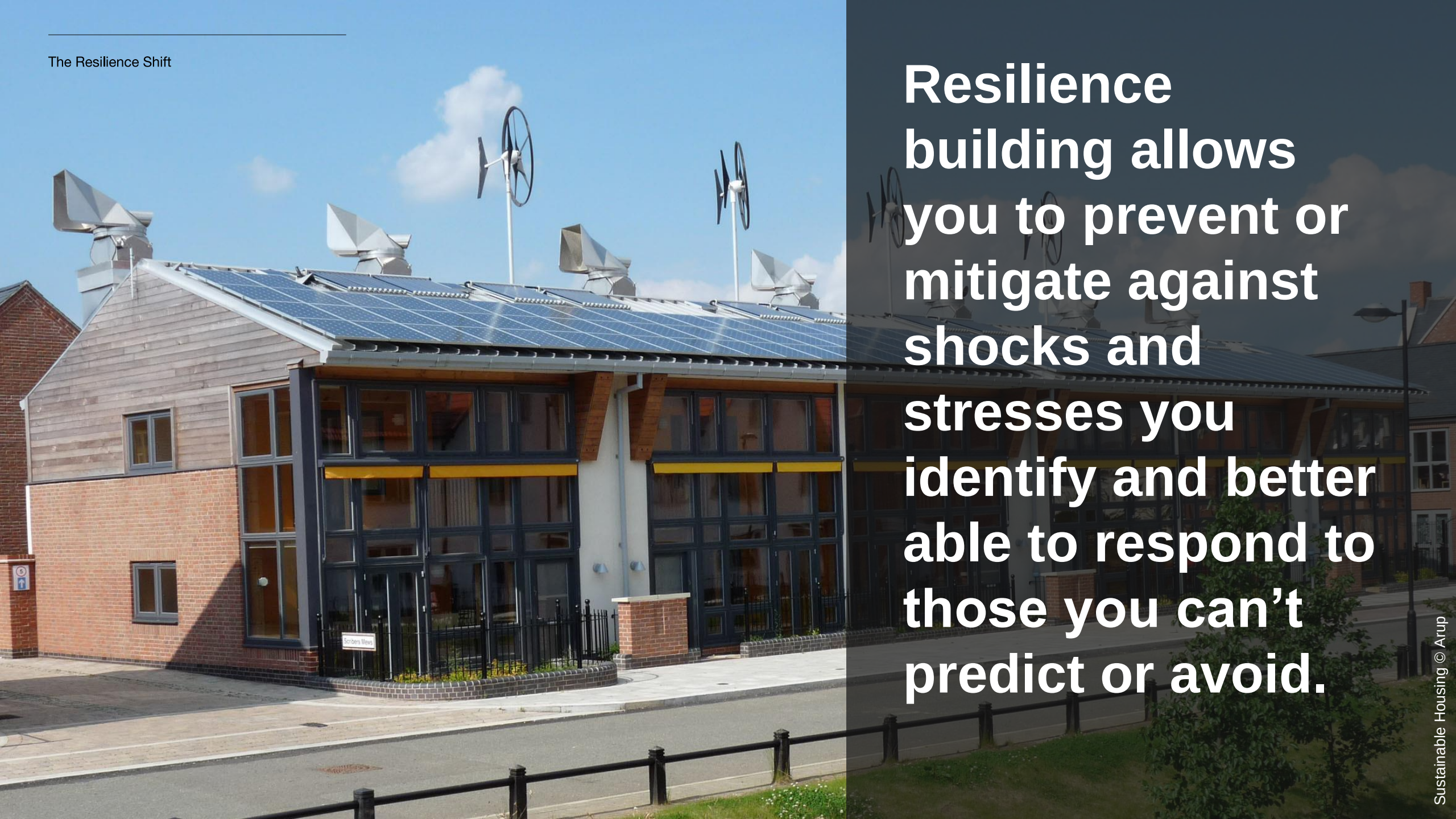

Resilience building allows you to prevent or mitigate against shocks and stresses you identify and better able to respond to those you can’t predict or avoid.

Resilience requires appreciation of complexity and the interdependence of systems and services underpinning modern life.