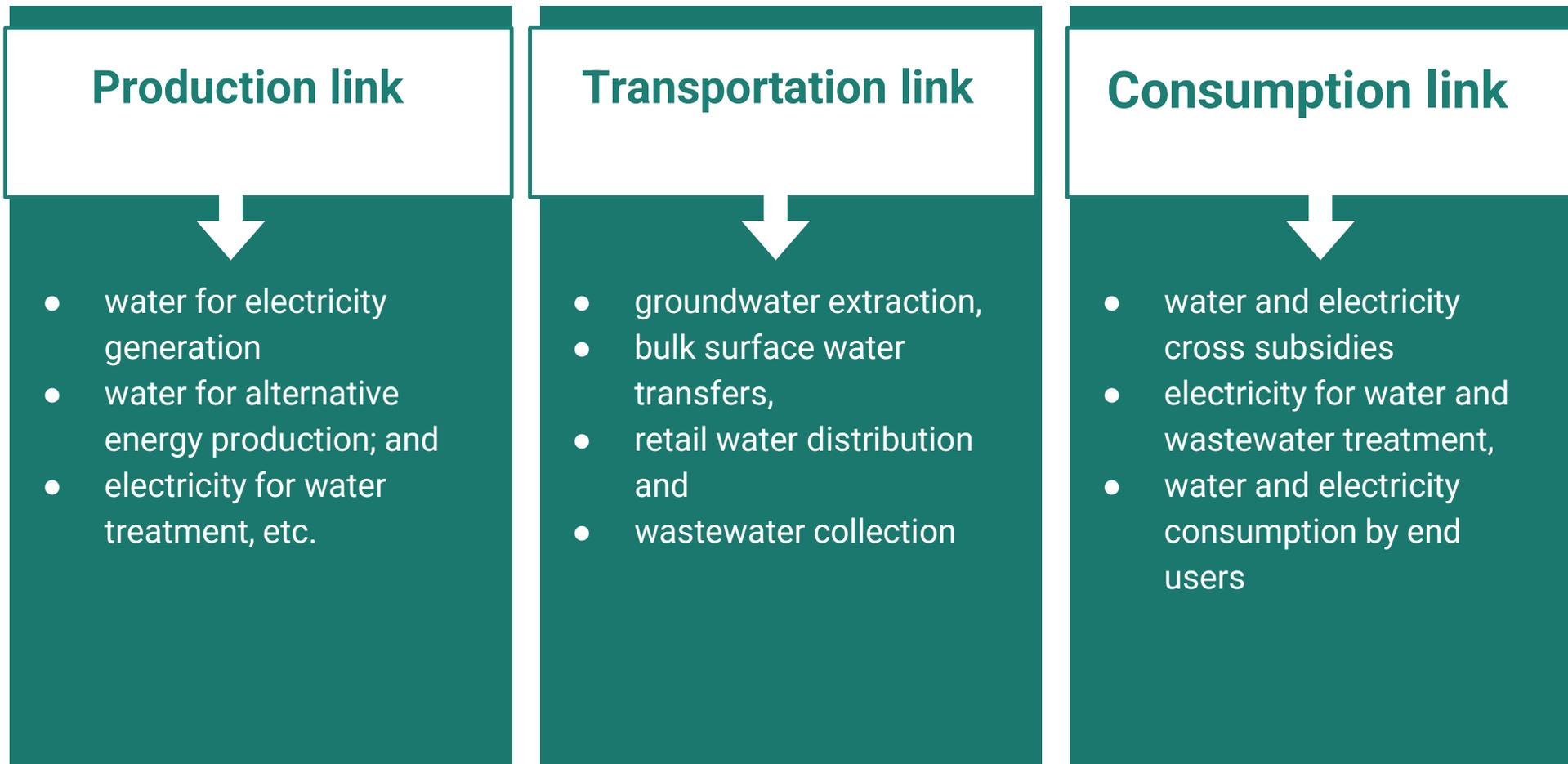

Transitioning Towards Water Sensitive Cities and its Co-Benefits for Energy Conservation



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National Institute for Environmental Studies, Tsukuba, Japan
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Water - energy nexus



(Source: Drawn by author, 2022 based on Hamiche et al., 2016)

Multi-dimensional Water - Energy nexus

01	Environmental	<ul style="list-style-type: none">• GHG emissions caused by human activity• Droughts putting pressure on water available for energy production or consumption
02	Technological	<ul style="list-style-type: none">• Energy intensive technological solutions
03	Economic	<ul style="list-style-type: none">• Pricing for economic efficiency vs subsidies• Eg. subsidized electricity prices may lead to over-exploitation of ground water resources
04	Political	<ul style="list-style-type: none">• Policies working in silos can gravely affect the water-energy nexus• Should not only focus on short-term goals
05	Social	<ul style="list-style-type: none">• Society to adapt to climate change putting pressure on both water and energy (Eg. hotter weather and ACs)• Society's attitude to new technologies or solutions; awareness and advocacy

(Source: Drawn by author, 2022 based on Hamiche et al., 2016)

Climate change driven extremes in India

- Lack of uniform trend but increasing spatial variability observed in studies linked to climate change
 - 1.69 to 2.37 billion urban population estimated to be facing water scarcity by 2050, of which 152-422 million in India alone (He et al., 2021)
 - Instances of water scarcity driven by climate change is as high as 30-50% in case of India (Vinke et al., 2017)

FLASH FLOODS IN BENGALURU, KARNATAKA, 2022

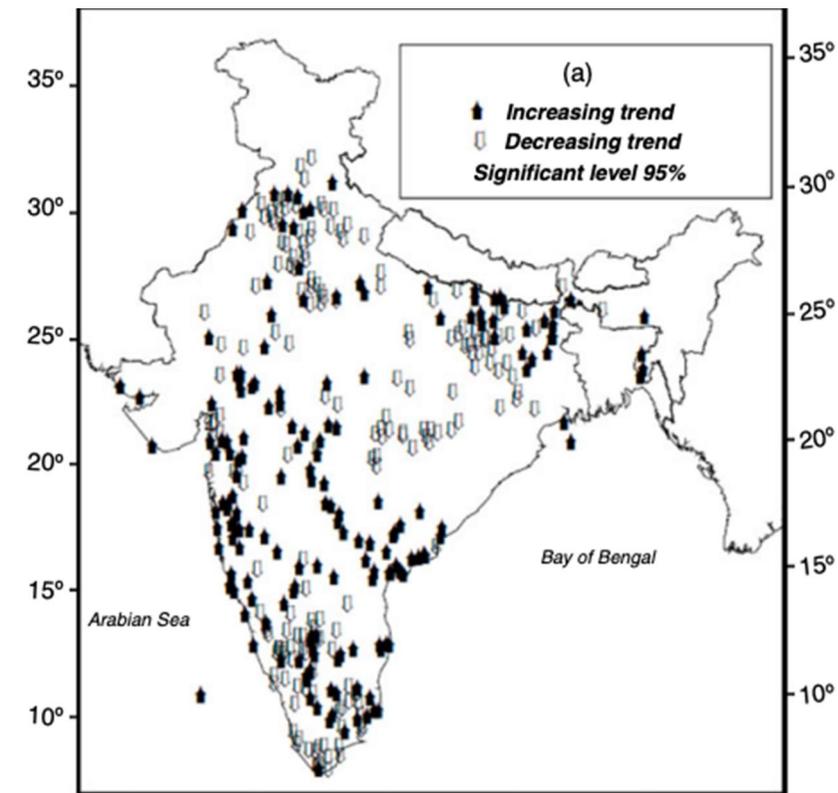


FLASH FLOODS IN ALLAHABAD, UTTAR PRADESH, 2022



Image 1: <https://www.indiatoday.in/india/story/heavy-rain-kerala-karnataka-bengaluru-uttar-pradesh-flood-1994508-2022-08-30>
Image 2: <https://newsaf.cgtn.com/news/2022-08-21/15-people-killed-in-flash-floods-in-north-India-1cF3cfEIHGM/index.html>

Stations with significant increasing/decreasing trend in one-day extreme rainfall at (a) 95% significance level



Source: Guhathakurtha et al., 2011

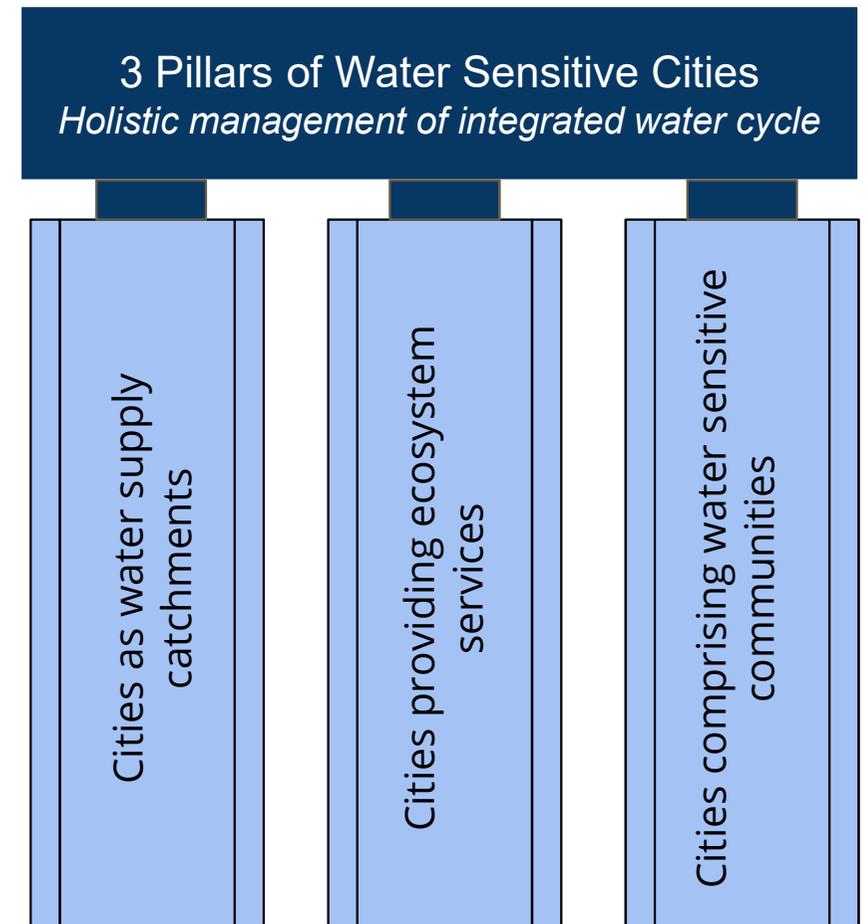
Emerging water management paradigms



Source: Redrawn by author, 2022 from Bichai et al (2018)

Water Sensitive Cities Concept

A "water sensitive city" (WSC) integrates normative 'Sustainable Urban Water Management Approach' values of **environmental protection, equity, rehabilitation, and sustainability** with necessary water services, such as **supply security, flood control, and public health**, as well as additional advantages like **food security, energy savings, amenity, and urban climate change resilience** (Wong & Brown, 2009)



(Source: Brown et al., 2016)

Water for Change Project

- A research based project to address the complex challenges to urban water systems faced by fast-growing cities resulting from population growth, rapid urbanisation and the **effects of climate change**
- Need for an **integrated systems approach** in developing interrelated technological, institutional and financial solutions for sustainable urban water management.



Department of Science and Technology,
Government of India
and Dutch Research Council, The
Netherlands



Total 11 research institutes. 05 in India
and 06 in Netherlands with 13 PhDs
(Out of which 03 PhDs are from MANIT)



3 pilot cities in India -
1. Bhopal, Madhya Pradesh
2. Bhuj, Gujarat
3. Kozhikode, Kerala

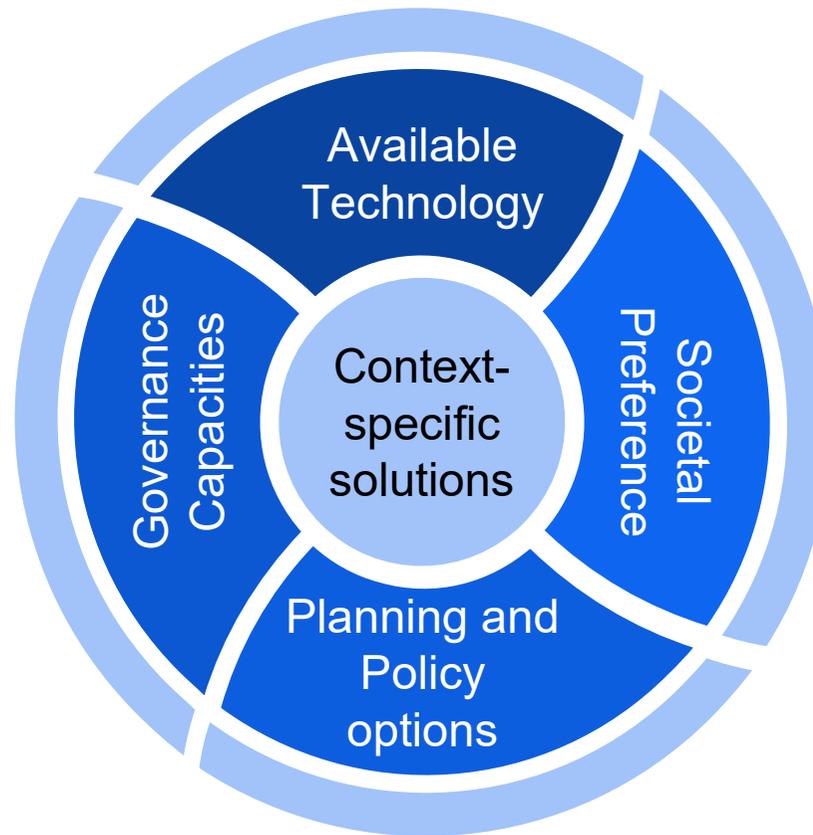
Water for Change Project

Process



Co-creative and co-producing

4 work-packages



Output



Integrative, fit-for-purpose guidelines for water-sensitive planning, design, and O & M of urban water system



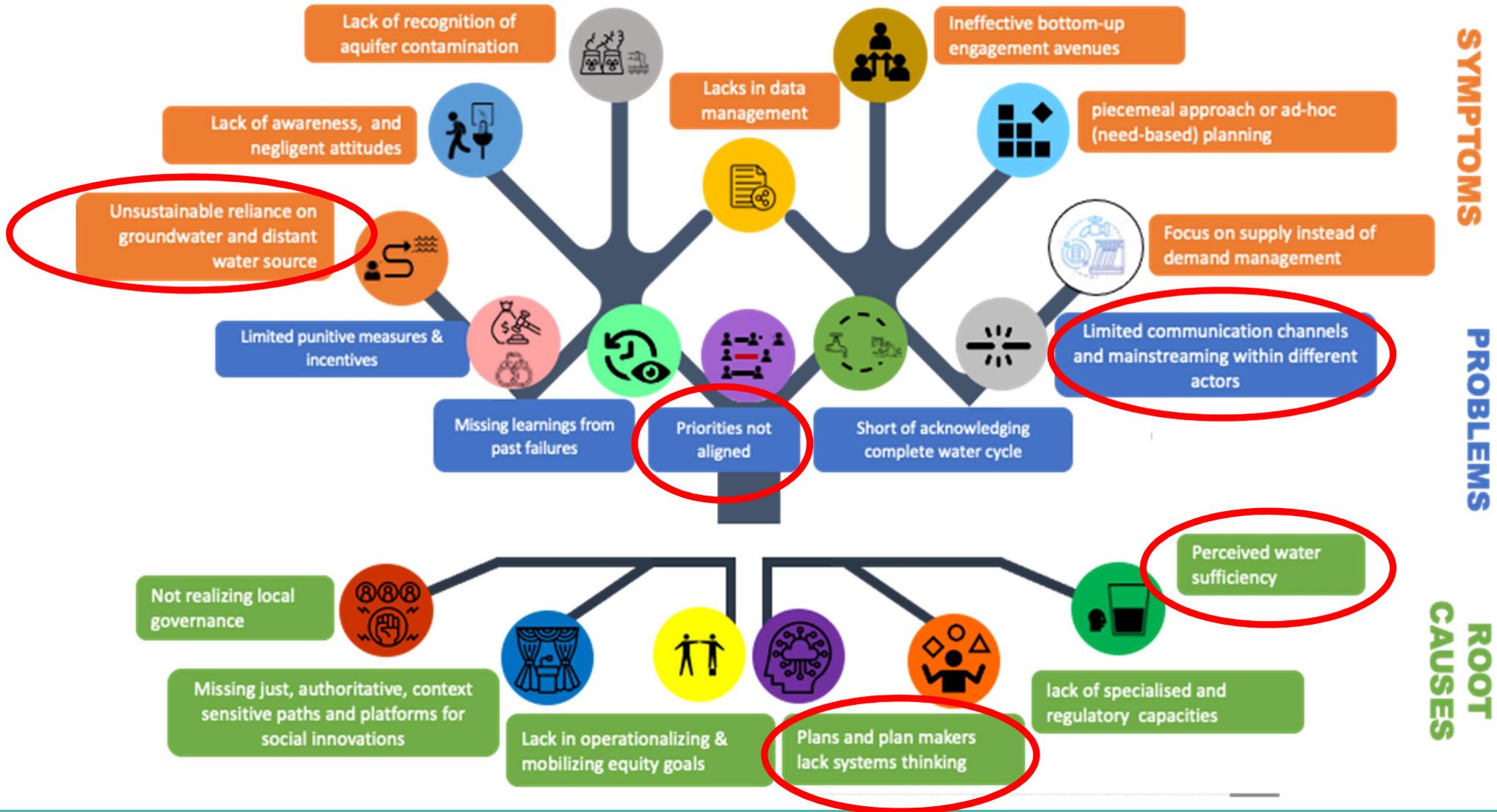
Water sensitive design and governance framework enabling institutional, behavioural, infrastructural, and socio-ecological change

Project methodology



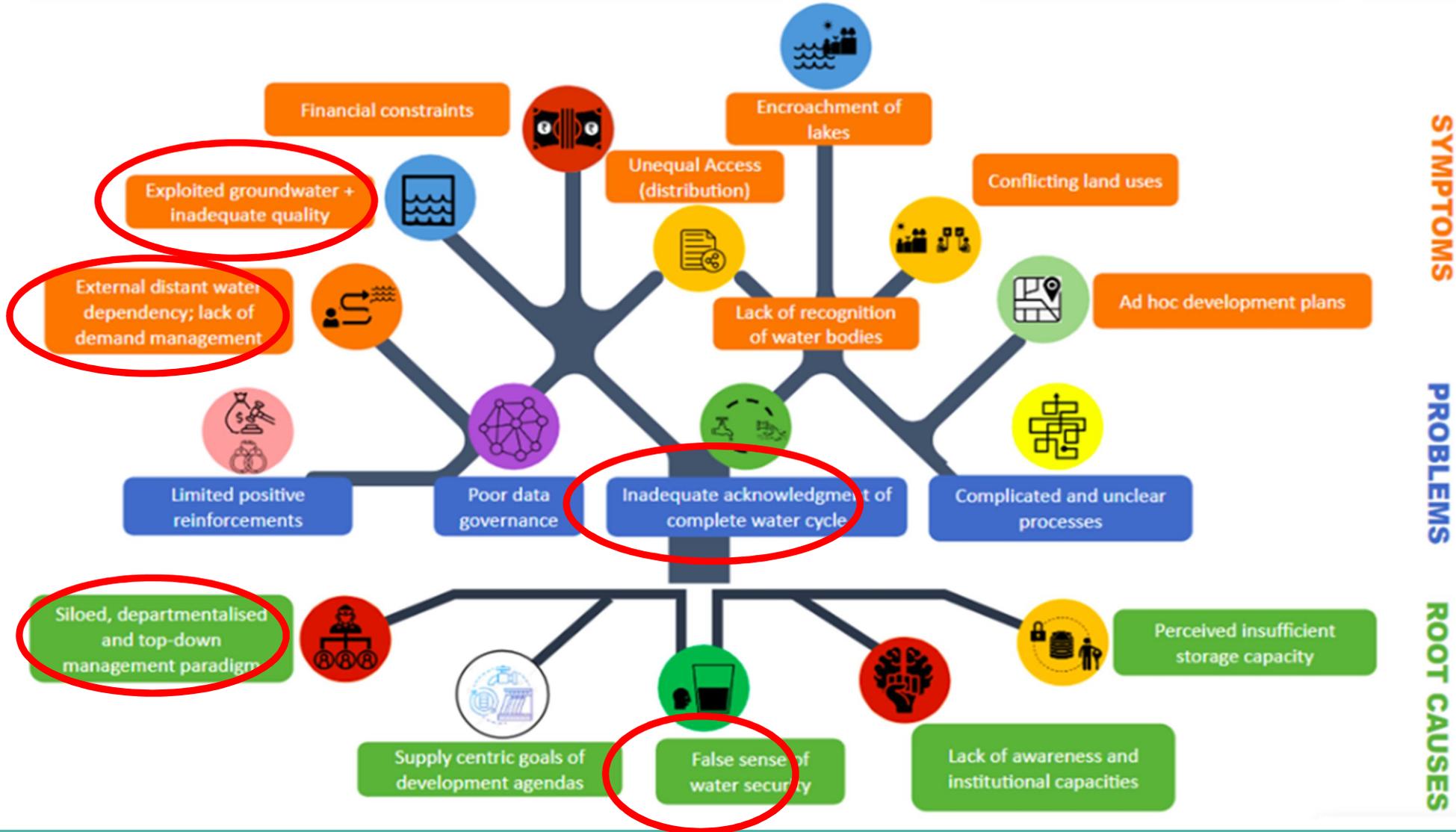
Output of Workshop 1 : Problem tree, Bhopal

Work in Progress. Please do not quote!



Output of Workshop 1 : Problem tree, Bhuj

Work in Progress. Please do not quote!



Output of Workshop 1 : Problem tree, Kozhikode

Work in Progress. Please do not quote!



Output : Vision for the three cities

Work in Progress. Please do not quote!

BHOPAL

- **Self-reliance** in water - local water sources as well as city acting as catchment
- **Sustainable use of water** - behaviour change as well as upgradation of technology to be energy efficient
- **Equity** so as to focus on assuring access to most **vulnerable sections** as well access to data and processes - responsive system

BHUJ

- **Self-sufficiency** in water - relying on local water sources
- **Recharge and reuse** of water
- **Innovative** (energy-efficient) water infrastructure
- **Metering** to reduce overconsumption
- **Equity** so as to focus on assuring access to most **vulnerable sections**

KOZHIKODE

- **Self-sustainable city in terms of** water sources
- **Water literacy** including
- **Equitable** water supply to focus on access to most **vulnerable sections** of society

Thank you!

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