# URBAN INFRASTRUCTURE RESILIENCE PROGRAMME

## STRATEGY

CDRI

Coalition for Disaster Resilient Infrastructure

Ministry of Infrastructure and Water Management


Deltares miyamoto.

**URBAN INFRASTRUCTURE RESILIENCE PROGRAMME**



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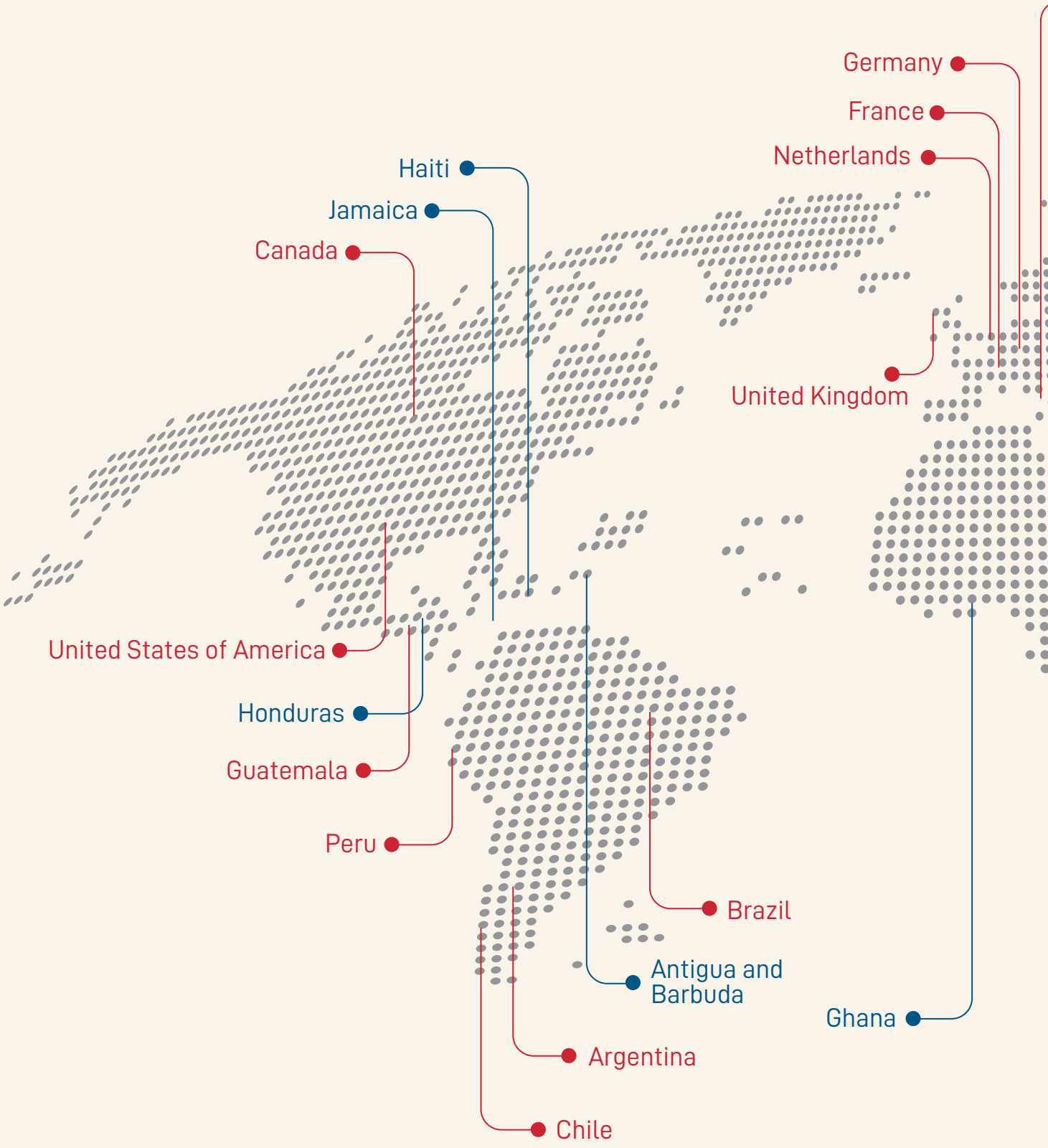
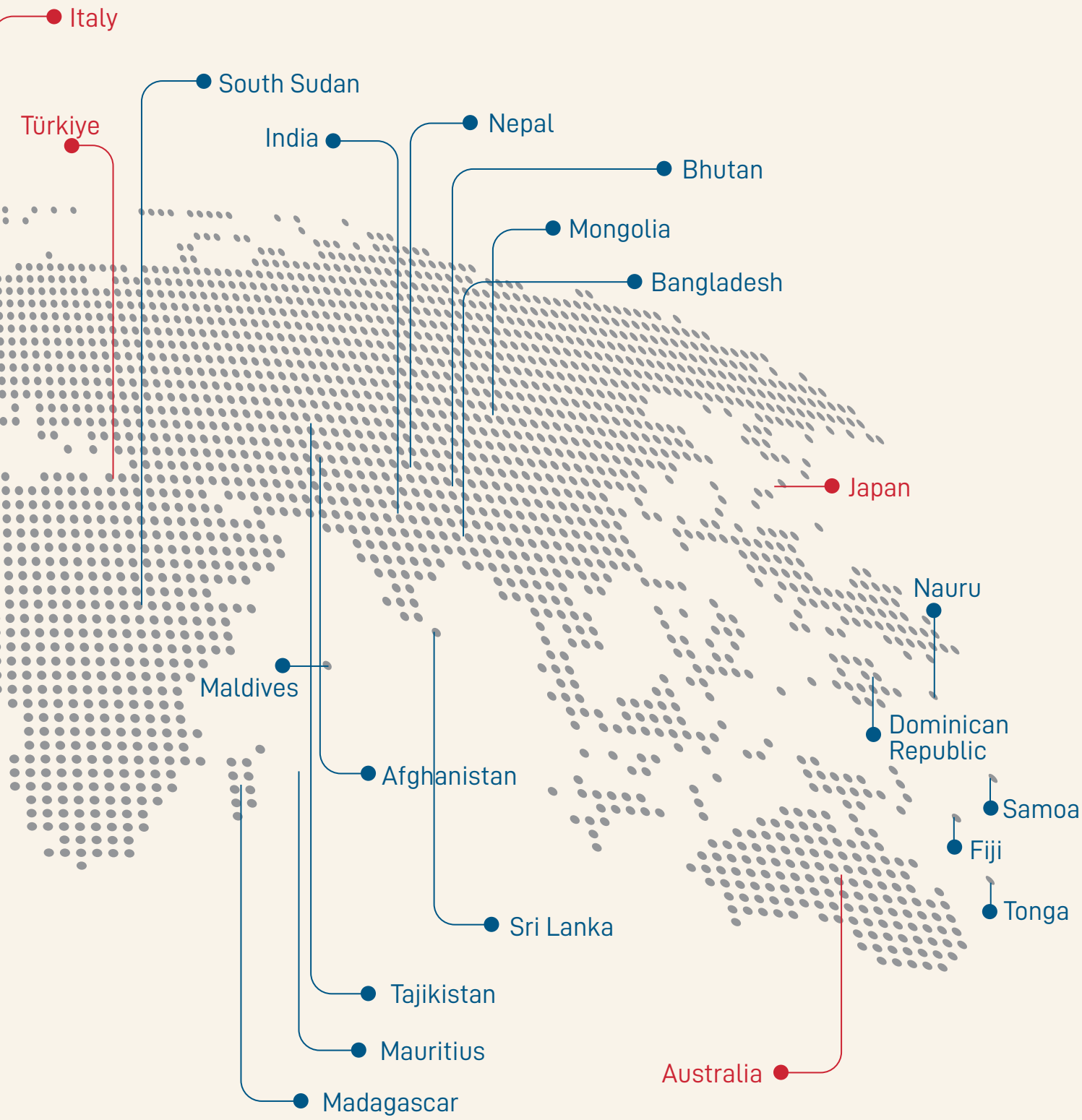
# CDRI MEMBER COUNTRIES




Low- and Middle-Income / Low Income / SIDS Member Countries

CDRI
Coalition for Disaster Resilient Infrastructure




Source: World Economic Situation and Prospects 2023, UN DESA

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# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| **ASEAN** | Association of Southeast Asian Nations |
| **AU** | African Union |
| **CDRI** | Coalition for Disaster Resilient Infrastructure (also "the Coalition") |
| **CoP** | Community of Practice |
| **COP** | Conference of Parties |
| **DRI** | Disaster Resilient Infrastructure |
| **EWS** | Early Warning System |
| **GDP** | Gross Domestic Product |
| **ICDRI** | International Conference on Disaster Resilient Infrastructure |
| **IRAF** | Infrastructure Resilience Accelerator Fund |
| **IRAX** | Infrastructure Resilience Academic eXchange |
| **IRIS** | Infrastructure for Resilient Island States |
| **LMICs** | Low- and Middle-Income Countries |
| **MDB** | Multilateral Development Bank |
| **NbS** | Nature-based Solutions |
| **NGO** | Non-Governmental Organization |
| **QUAD** | Quadrilateral Security Dialogue |
| **SDG** | Sustainable Development Goal |
| **SFDRR** | Sendai Framework for Disaster Risk Reduction |
| **SIDS** | Small Island Developing States |
| **SOP** | Standard Operating Procedure |
| **SWP** | Strategic Work Plan |
| **ToC** | Theory of Change |
| **UIRP** | Urban Infrastructure Resilience Programme |
| **ULBs** | Urban Local Bodies |
| **UN** | United Nations |
| **UNDP** | United Nations Development Programme |
| **UNDRR** | United Nations Office for Disaster Risk Reduction |
| **UNMPTFO** | United Nations Multi-Partner Trust Fund Office |

# EXECUTIVE SUMMARY

Cities play a pivotal role in global economy, contributing to more than 80% of the global Gross Domestic Product (GDP). Urban areas flourish economically due to the dense aggregation of individuals, infrastructure, enterprises, and resources within compact geographical zones. Infrastructure stands as the very backbone of city progress and economic development. **Presently, more than half of the global population resides in urban areas, a number anticipated to rise to 70% by 2050 and an overwhelming 85% by 2100.** As cities continue to burgeon and attract a significant portion of the global population, well-designed and efficient urban infrastructure becomes indispensable.

On a global scale, **70% of Average Annual Losses (AAL) are attributed to climatic hazards, marking a significant impact on urban areas.** Among these hazards, rising temperature extremes, increased flooding, and water scarcity and security stand out as major climate change threats confronting cities. Climate variability has given rise to compounded hazards, combining warming and precipitation extremes in various parts of the globe. In 2023, **temperatures surpassed the pre-industrial average for 1850-1900 by a significant 1.5°C.** The repercussions of this human-induced climate variation are already evident worldwide, manifesting in extreme weather events and climate-related hazards.

Extreme climate hazards magnify disaster risk, asset loss, and service disruption, while existing infrastructure may lose its functionality. The damage or disruption of service of any infrastructure in city systems will also create compounding risks and cause widespread transboundary disruption in services.

As a global partnership, the Coalition of Disaster Resilient Infrastructure aims to ensure that the investments of its members and partners are aligned and well-coordinated in support of the shared ambition of disaster and climate resilience of new and existing infrastructure. **CDRI's Urban Infrastructure Resilience Programme (UIRP) aims to enhance urban livability by promoting resilient infrastructure planning and implementing data-driven decision-making processes to manage urban shocks and stresses.** UIRP initial work will focus on climate change-related hydro-meteorological challenges, such as extreme flooding, water scarcity, and heat, which are anticipated to significantly impact urban areas and populations. These challenges will disproportionately affect crucial services and urban development, especially vulnerable communities in Low- and Middle-Income Countries (LMICs) and Small Island Developing States (SIDS).

To achieve the overarching goal of improved urban resilience in LMICs, CDRI has identified three objectives which form the building blocks of the urban strategy.

**City infrastructure environment, services and systems are resilient against climate extremes through:**

- **Improved engagement** with Member Countries and Partner Organizations
- Increased access to **infrastructure finance** through MDBs/investment banks/financing corporations
- **Access to data, tools and knowledge** by Urban Local Bodies (ULBs) leading to improved design, operation, and maintenance of infrastructure.

These objectives will be achieved through four intervention pillars which are mutually reinforcing. The four pillars are (i) Improved Awareness and Capacities (ii) Informed Infrastructure Planning (iii) Augmenting Financial Resources and (iv) Integrating Resilience into Infrastructure Operations and Maintenance.

The UIRP will be implemented through meticulously planned projects and interventions, targeting cities across varied geographic regions and exposed to diverse risks and natural hazards. In its initial phase, UIRP will concentrate on challenges related to extreme heat, urban flooding, and water scarcity in urban areas. These projects will have cross-cutting initiatives, addressing multiple outcomes, and will be funded through the CDRI's Multi-Partner Trust Fund, namely the Infrastructure Resilience Accelerator Fund (IRAF).

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CHAPTER 1

# Cities as Engines of Growth

## 1.1. Cities as Economic Hubs: Driving Global Growth

**Cities play a pivotal role in the global economy, contributing to more than 80% of the global Gross Domestic Product (GDP)** (World Bank, 2021). Urban areas thrive economically due to the dense aggregation of individuals, infrastructure, enterprises, and resources. This concentration enables them to capitalize on economies of scale and agglomeration, leading to sustained economic growth. Moreover, urban areas serve as epicentres for innovation, often pioneering the early adoption of technological advancements. Cities are progressively developing digital twin to enhance the efficiency and effectiveness of necessary service delivery including but not limited to quality education, health care, environment and livelihood. Therefore, the demand for smart city solutions and systems is projected to rise by 25% annually, reflecting the growing trend toward advanced urban technologies (Allied Market Research, 2022).

## 1.2. The Urbanization Landscape

Urbanization and economic growth are deeply interconnected, serving as the cornerstone of national and subnational development across economic and social dimensions. **Cities operate as vital hubs, fostering essential economic, political, and social interactions (Duranton & Puga, 2004).** The concentration of people and businesses in urban areas facilitates the seamless exchange of resources and creation of new knowledge. Cities that offer superior amenities, robust infrastructure, and a high standard of living attract populations in search of enhanced opportunities, thereby nurturing innovation, technology, and creativity.


*Figure 1.1: Projected urbanization across the world*

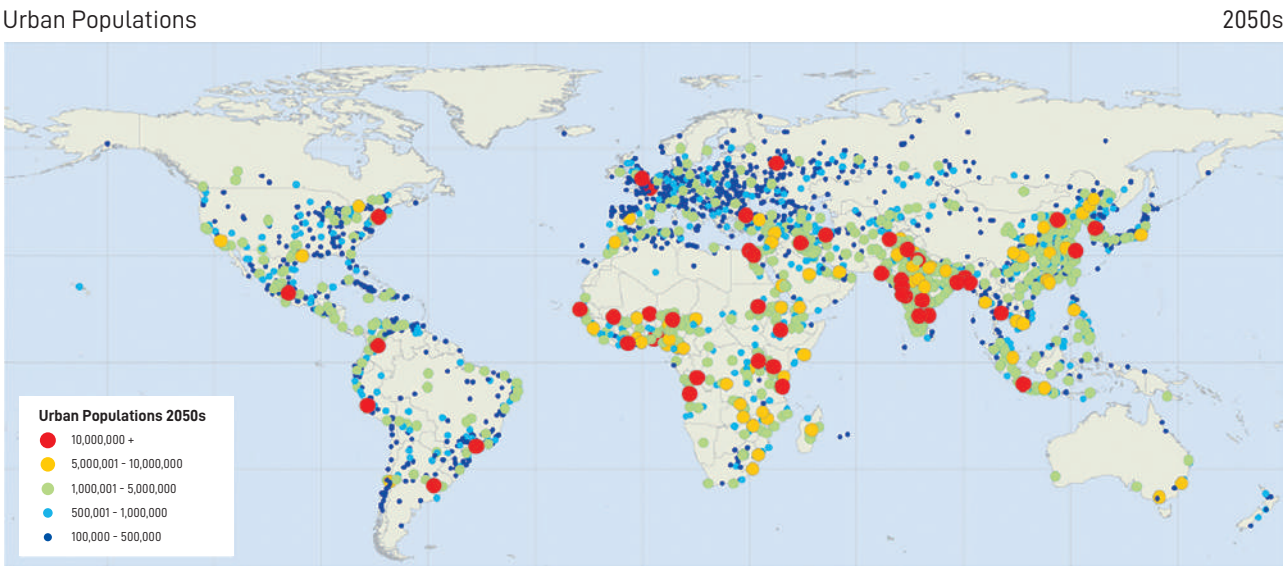



*Figure 1.2: Projected urban populations in the 2050s. Source: (C40 et.al, 2018)*

**The global significance of cities is set to increase in the coming decades.** However, the global trend of urbanization translates into growing urban populations, intensifying pressure on existing infrastructure. Additionally, shifting demographics, including changes in population distribution, age structure, and socio-economic patterns, pose significant implications for future infrastructure needs including strengthening of the existing blue and green infrastructure.

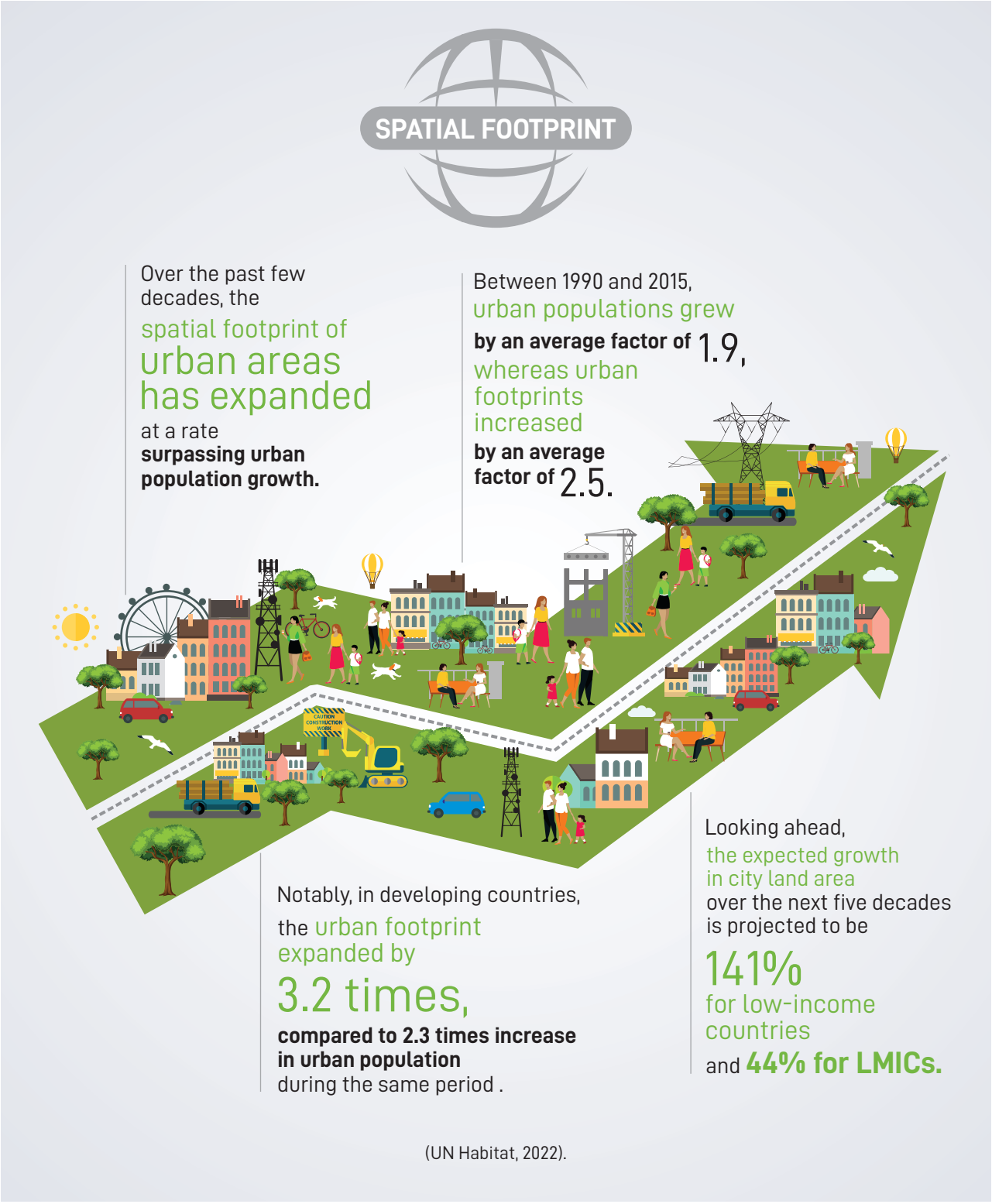



*Figure 1.3: Urban spatial footprint expansion*

## 1.3. Urban Infrastructure - Backbone for development

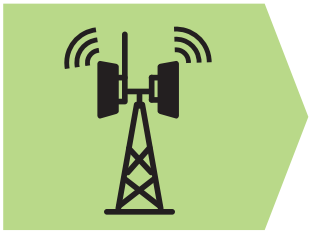
Infrastructure stands as the very backbone of city progress and economic development. As cities continue to burgeon and attract a significant portion of the global population, well-designed and efficient urban infrastructure becomes indispensable. **Roads, bridges, public transportation systems, energy networks, water supply, and telecommunication networks constitute the vital backbone, upon which urban life is dependent.** Quality urban infrastructure not only enhances the living standards of citizens but also fosters economic growth by facilitating the movement of goods, services, and people. Moreover, it creates an environment conducive to business activities and innovation, attracting investments and encouraging entrepreneurship. **Accessible healthcare, education, and essential services, all made possible through robust urban infrastructure, contribute to healthier, more educated, and economically empowered societies.** In essence, the development and maintenance of urban infrastructure are central to ensuring sustainable and inclusive growth, making it an indispensable pillar of modern civilization.

### TRANSPORTATION

Transportation infrastructure is the fundamental physical network of a city, providing access to urban services, movement of goods and people, underpinning social and economic functions of the urban area. It supports urban areas to leverage benefits of agglomeration by expanding commuting options for the workers, integrating suburban areas into urban economy providing more access to jobs and thus increasing standard of living.

### ENERGY

Energy infrastructure includes the complex network of equipment, systems and facilities generating, transmitting, and distributing electricity to meet energy demands in urban areas - often extending beyond urban boundaries. It fosters the urban economy by powering businesses and industries, and enhances resilience by ensuring continuity of urban services like transportation, communications, health, etc.

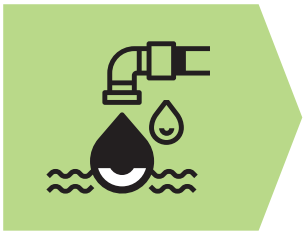


### TELECOMMUNICATION

Telecommunication infrastructure, including networks of high-speed internet and mobile, enables seamless communication and forms the connectivity backbone of cities of tomorrow, considering the transformative shift to smart cities.

### BUILDINGS

Buildings in urban areas provide infrastructure for shelter, living and working spaces contributing to the livability and economic productivity in cities. The sustainable planning and design and spatial quality of buildings including housing, hospitals, educational institutions, and public spaces such as parks, city green spaces, etc., aid in efficient functioning of city.



### WATER

Water infrastructure in cities plays a dual function; they provide water services to the city while reducing the risk to other services from natural hazards such as flood and droughts. The urban water supply system, sanitation, water treatment plants, urban drainage system, stormwater drainage and flood defenses are all interlinked. City utilities, including essential services such as water supply, sewage systems, storm water pipes etc., play a crucial role in functionality and well-being of citizens.

*Photo by Pradeep Gaurs on Shutterstock*

## 1.4. Investments in Infrastructure

**Projections indicate that the world's infrastructure demands will reach a staggering $94 trillion between 2015 and 2040** (GIH, 2017). An essential aspect of this challenge lies in accommodating the growing global population. The accelerated pace of urbanization in the global south further amplifies this demand, with a significant share of the required investments emerging from this region. Concurrently, there exists a stark imbalance in global infrastructure investments, with **high-income countries having a capital stock value of $200,000 per capita invested over the past half-century, while the figure is $11,000 for LMICs** (CDRI, 2023). Given these disparities, strategic efforts are required to bolster infrastructure investments, particularly across urban areas in LMICs, to ensure sustainable development and equitable progress.

In the majority of cities, traditional public finance methods such as taxes, revenues, fees, and intergovernmental transfers constitute the primary sources for infrastructure investments. However, to effectively bridge the infrastructure investment gaps, especially in LMICs more diverse financing options are essential. These should include private, public, domestic, international, and experimental financing schemes. According to the UN Habitat 2020 Report on Financing Sustainable Urbanization, **cities require around $38 trillion of investment in infrastructure over this decade to achieve Sustainable Development Goal 11.** However, there exists a notable investment gap of approximately $5.6 trillion for the same period. Therefore, there is a need for innovative funding mechanisms especially within private and public investments to bridge this significant gap effectively.

### Summary

Cities are the economic hubs driving the global economy with concentration of resources, technology and innovation. As the world urbanizes with increasing global share of urban population, the importance of robust urban infrastructure to support people and the economy is needed. Considering the anticipated urbanization, especially in low and low-middle income countries, and relatively limited infrastructure investments, it is imperative to significantly boost infrastructure investments in cities within these regions.

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CHAPTER 2

# Cities and Climate Variability

## 2.1. Urban Development - Complexity and Challenges

Urban landscapes exhibit diverse developmental trajectories, influenced by both organic growth shaped by natural elements like rivers, and planned structures designed for specific functions such as commerce, administration, tourism, and transportation. Each city possesses a unique developmental profile, characterised by varying urbanisation trends, scale complexities, and geographic nuances. The absence of risk-informed planning exacerbates challenges in these rapidly evolving urban centres. Notably, **Asian and African cities are identified as regions with heightened risk due to anticipated climate changes, extreme weather events, unplanned urban expansions, and rapid land use alterations (IPCC, 2023). Smaller cities, covering nearly 45% of the land area in low-income countries,** hold significant importance in the urban landscape. Therefore, focusing strategically on the development of these smaller cities and semi-dense areas is imperative to achieve sustainable development goals, as emphasised by UN Habitat (2022). CDRI's landscape research explores the multifaceted challenges and nuances of urban development identified the need for informed and strategic planning in these diverse urban settings.

### Urban Planning

Effective urban planning ensures accessibility, interconnectivity, and proper zoning of critical and social infrastructure systems and services. The implementation of innovative urban planning strategies, incorporating context-responsive land use regulations and interventions, is essential for comprehensive and sustainable city development. **These strategies facilitate the judicious utilisation of natural resources, optimal operation of infrastructure, and effective management of urban challenges, particularly climate-related risks.**

Inadequately planned cities can significantly amplify existing risks or even introduce new and compounded challenges. Urban expansion into hazard-prone areas like flood plains and the proliferation of illegal constructions without adhering to bylaws can transform natural hazards into disasters. **Currently, up to 90% of the urban population in low-income countries reside in unsafe, exposed housing, intensifying their vulnerabilities (UNDRR, 2013).**

Furthermore, disparities in access to urban infrastructure, especially among the urban poor lacking basic services, lead to disproportionate impacts.


*Figure 2.1: Disparities in access to urban services*

**While access itself may be less of an issue in higher-income countries, the quality of many basic services poses significant challenges.** Additionally, urban infrastructure in these countries is aging, making it more susceptible to failures, increased maintenance costs, and reduced efficiency.

The increase in built-up and impervious surfaces at the expense of green open spaces exacerbates hazard risks. Surfaces like roofs and pavements constructed with low albedo materials absorb more heat and are resistant to cooling, contributing to the urban heat island effect. **Urban areas can be up to 12°C hotter than their rural counterparts due to these factors (U.S. EPA, 2008).** Proper urban planning and thoughtful infrastructure management are paramount to mitigating these challenges and fostering resilient, sustainable urban environments.

### Urban Governance/Administration

**Urban governance and administration should have a multifaceted approach** in response to the uncertainties arising from climate hazards. This necessitates transformational adaptation and reflexive governance tactics. Governance systems must adapt positively to the ever-changing needs, expectations, rights, and capacities of all stakeholders including institutions responsible for infrastructure decision-making. Coordinated adaptation is essential for ensuring more equitable outcomes especially across vulnerable communities.

**Effective urban governance models should align with well-structured, multi-level governance systems.** These systems should enable each level of government to focus on implementing resilient interventions where it is best positioned to do so. A comprehensive and responsive approach not only promotes adaptive strategies but also ensures the inclusion of diverse perspectives, fostering fair and equitable urban resilience outcomes.

### Resource Constraints

**Cities face a pressing need to enhance their creditworthiness to access financial markets for crucial infrastructure investments.** While high- and middle-income countries have made notable strides in this area, cities in low-income countries and Small Island Developing States (SIDS) still have a long way to go.


**and about 20% of all cities in developing nations can issue bonds to local investors**

(UN Habitat, 2022)

Globally, a substantial **51% of city income stems from grants and subsidies** provided by higher levels of government, international organisations, and international aid. However, a mere **1.3% of the total assistance from bilateral organisations** reaches cities, indicating a disproportionate allocation of funds toward broader national initiatives rather than localised efforts (UN Habitat, 2022).

Inadequate investment in cities, particularly in low-income countries and SIDS, results not only from their lack of creditworthiness but also due to insufficient technical capacities among urban professionals. Strengthening the technical abilities of urban practitioners to tackle challenges arising from rapid urbanisation and elevated risks of natural hazards is crucial in enhancing the financial capacities of cities. Furthermore, alongside upskilling, bolstering institutions responsible for delivering services, managing resources, and making decisions within the city is indispensable.

**Institutional strengthening** is essential to equip decision makers in developing countries to meet the demands and confront the challenges of the cities of tomorrow. This dual approach of enhancing technical expertise and **fortifying institutional frameworks** is pivotal in ensuring financial resilience and sustainable urban development.

### Data, Information, and Tools Informing Urban Development

Utilising **disaggregated spatial data at the urban level,** is crucial for pinpointing specific areas requiring focused interventions. This approach not only enhances the effectiveness of interventions but also promotes a more equitable distribution of resources and investments. However, cities, particularly in developing nations, often face significant challenges in this realm.

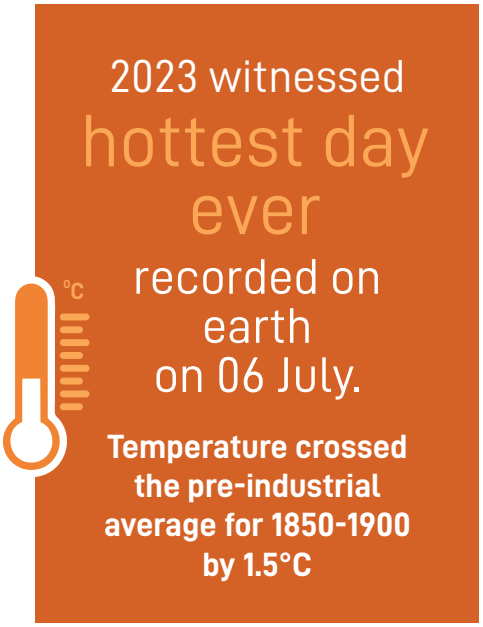
Many **cities lack the essential human resources, technological infrastructure, and tools** necessary to efficiently collect, analyse spatial data into actionable information for risk-informed decision-making. Moreover, these cities encounter obstacles in accessing existing data from diverse global platforms, primarily due to financial constraints and technical limitations. Addressing these challenges is pivotal for fostering informed, targeted, and equitable urban development initiatives.

## 2.2 Mapping Global Climate Trends across Cities

**From 2011 to 2020, the global surface temperature rose by approximately 1.1°C above the 1850-1900 baseline levels,** with a more pronounced increase observed over land compared to the ocean. This warming trend signifies a concerning deviation from historical norms. The repercussions of this human-induced climate variation are already evident worldwide, manifesting in extreme weather events and climate-related hazards. Numerous regions have suffered substantial damage to critical infrastructure and key economic sectors due to these extremes, notably in Australia, Asia, North Americas, Europe, Africa, Small Islands, coastal cities, and mountainous regions (IPCC, 2023).

Climate variability has given rise to compounded hazards, combining warming and precipitation extremes in various parts of the globe. The months of **July, August and September of 2023 marked the hottest three-month period in recorded history,** with 06 July 2023 being the hottest day on record. Temperatures surpassed the pre-industrial average for 1850-1900 by a significant 1.5°C (WMO, 2023a) (WMO, 2023b). It is anticipated that these climate records will likely be surpassed within the coming decade.

Rising temperatures and heatwaves have resulted in elevated mortality and morbidity rates, with the impacts varying based on factors such as urbanization and socio-economic conditions (including age, gender, and income). Alarmingly, the **population exposed to heatwaves continues to expand alongside the warming trend, posing a growing challenge to public health and urban planning efforts.**



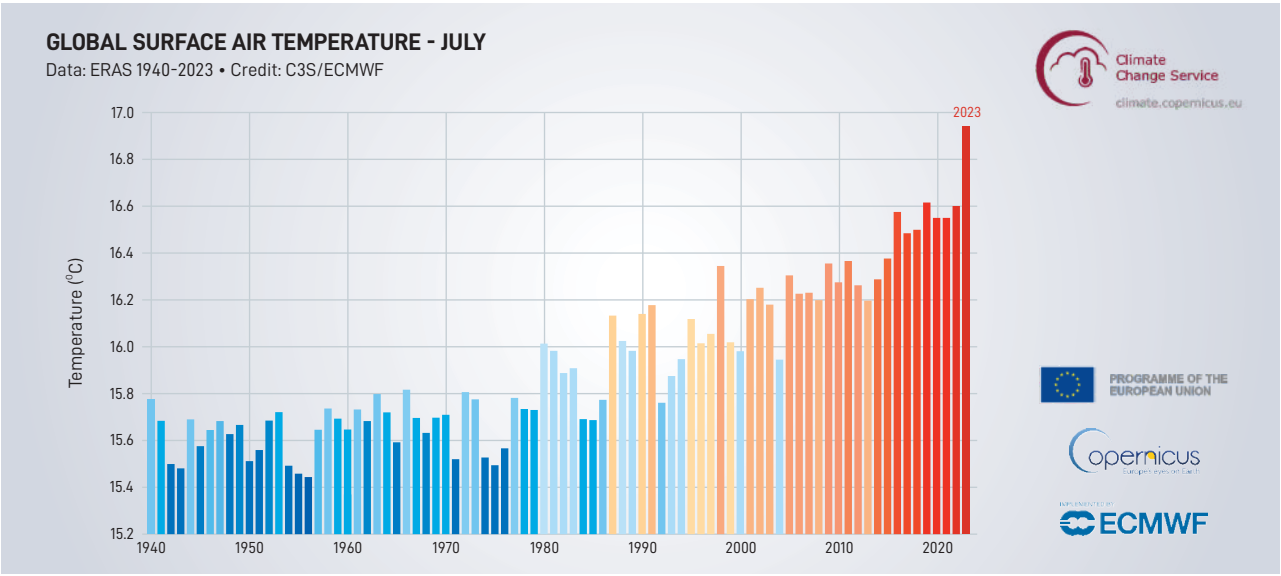




*Figure 2.2: Globally averaged surface air temperature for all months of July from 1940 to 2023.*

*Source: Data: ERA5. Credit: C3S/ECMWF (WMO, 2023a) Shades of blue indicate cooler-than-average years, while shades of red show years that were warmer than average.*

**Approximately half of the global population encounters severe water scarcity for at least one month annually,** attributed to a combination of climatic shifts and human-induced factors (IPCC, 2022). These circumstances, characterized by extreme events and underlying vulnerabilities, have disrupted energy production, increased waterborne infections, and amplified the socio-economic repercussions of both droughts and floods.

Climate change has intensified the global hydrological cycle, leading to unfamiliar precipitation patterns, including extreme events. **Projections indicate a rise in precipitation intensity, amplifying local flooding generated by rainfall.**

**Between 2000 and 2019**

Floods adversely affected **1.65** billion people

Droughts impacted **1.43** billion people

**causing widespread social and economic disruptions worldwide.**

The economic impact was substantial, with recorded **damages from droughts and floods amounting to**

**$764 billion**

during the period 2000-2019 (Browder, et al., 2021).

Nearly 95% of the reported infrastructure loss and damage between 2010 and 2019 were attributed to water-related disasters (UNDRR, 2023).

Cities and Climate Hazards

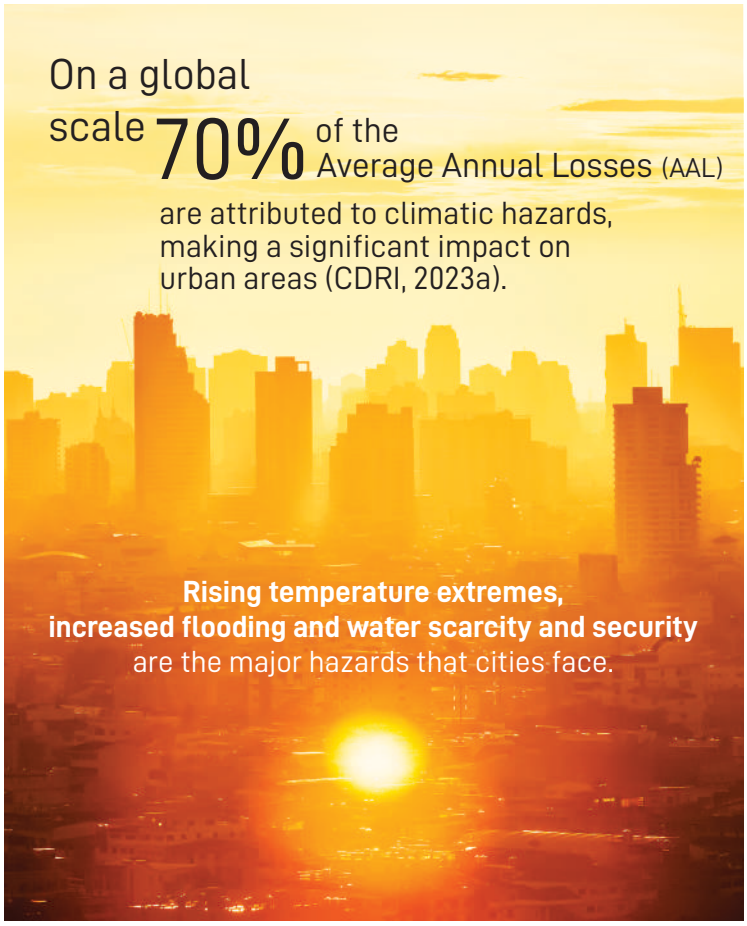



*Photo by TWStock on Shutterstock*

## Heat Impacts

In the current context, more than 350 cities home to over 200 million people are vulnerable to extreme heat conditions. In other words, **14% of the global urban population is already encountering extreme heat.** Projections suggest that **by 2050, 45% of the global urban population will be vulnerable to such extremes.** Estimates indicate that between 50% to 75% of the world's population could confront "life-threatening climatic conditions" due to extreme heat and humidity by the end of the century. Notably, regions such as **Asia, Africa, and North America are particularly prone to extreme temperatures, with summer highs surpassing 35°C (C40, et al., 2018).**

Extreme Heat 2050s

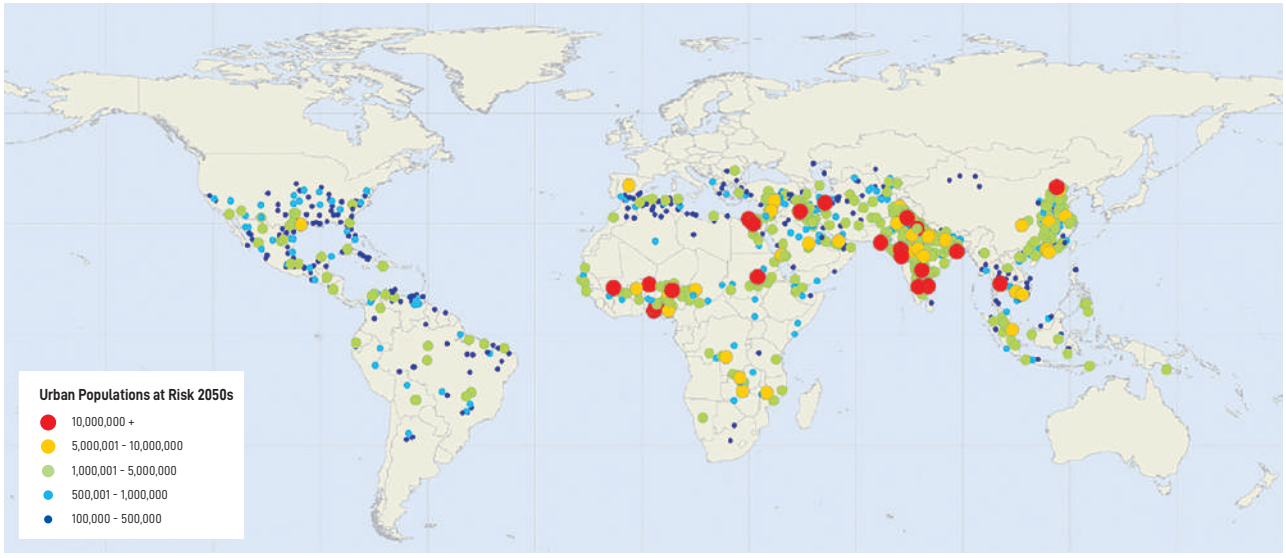



*Figure 2.3: Urban populations at risk to extreme heat in 2050*
*Source: (C40, et al., 2018)*

| | |
|---|---|
| ASIA | **Southeast Asia experienced a "once-in-200 years" heatwave in April-May 2023,** causing widespread hospitalizations, damage to infrastructure, wildfires, and school closures. In 2023, Japan experienced its hottest summer on record whereas February of the same year was warmest in India over 122 years. |
| AFRICA | **Sub-Saharan Africa accounted for nearly two-thirds of the global surge in urban exposure to extreme heat in recent decades** (Tuholske, Funk, & Grace, 2021). A three-day heatwave in the Western Mediterranean region, originated in North Africa in April 2023 broke temperature records in some African countries. Cairo city in Egypt experienced weeks of power cuts and fires due to heatwave in 2023. |
| EUROPE | On 1 January 2023, **at least eight European countries recorded their warmest January day ever.** Starting on 10 July 2023, Europe experienced record breaking 'Cerberus Heatwave' impacting parts of Southeast and Southwest Europe. Around 3,100 people died in the first 9 months of 2023 in Germany due to high temperatures. |
| AMERICAS | **Extreme heat is already costing the U.S. economy $100 billion annually, a price tag that could increase to $500 billion by 2050** (Fortune, 2023). More than 80 million people in western and southern states of the US were under advisories for a "widespread and oppressive" heatwave during July 2023. Around 2,200 acres on the Canadian side borders were on fire due to extended dryness and heat in June into July. |

*Figure 2.4: Extreme heat impacts across various regions*

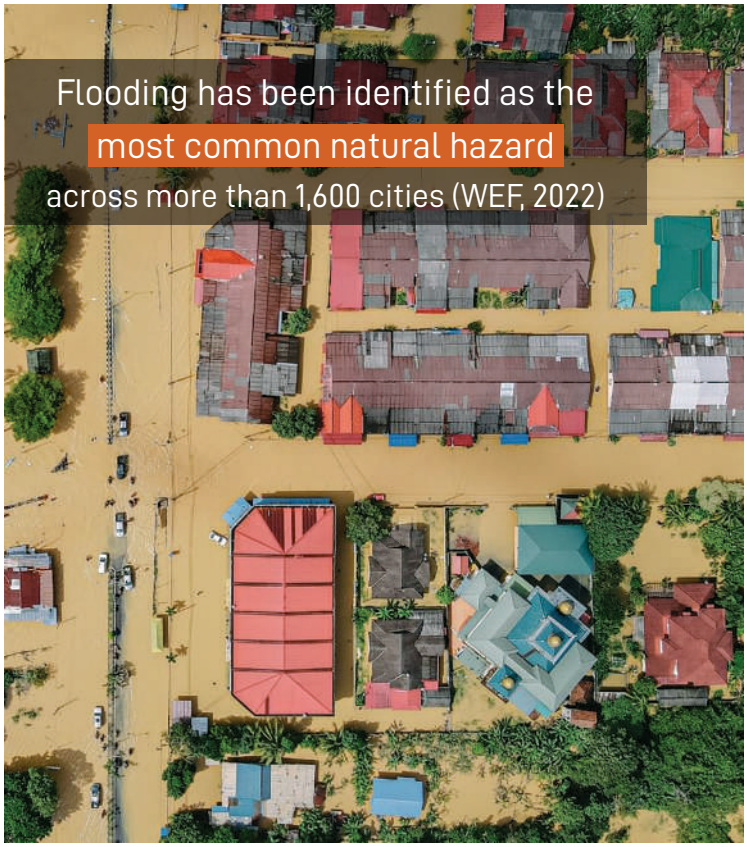



*Photo by Pok Rie on Pexels*

## Flood Impacts

Over the last two decades, **flooding has been the most prominent disaster, accounting for 44% of total reported events** (CRED, 2020). Flooding has been identified as the most common natural hazard across more than 1,600 cities, each with over 300,000 inhabitants (WEF, 2022). Globally, 1 in 4 people live in high flood risk zones, and in middle-income countries, **81% of urban settlements are prone to floods.** While countries at all levels of development face flood risk, **vast majority of the world's flood-exposed people 89% live in 'LMICs** (Rentschler & Salhab, 2020). **About 11 million people living today in port cities in low-income countries are exposed to coastal flooding** and considering the limited protection and often no formal warning systems, the human consequences of flooding could be significant (Nicholls, et al., 2007).


*Photo by RicAguiar on Canva*

| | |
|---|---|
| **ASIA** | Globally, Asia has witnessed the highest impact due to flooding in the last two decades in terms of experiencing **41% of all events and accounting for 93% of people affected by floods** (2000-2019), followed by Africa and Americas (CRED, 2020). In September 2023, Japan experienced precipitation (391.5 mm) that marked a record high in 10 years. In Mobara city, the record rain resulted in more than 200 landslides and caused disruption of transportation services and infrastructure, with damage to roads and railways. |
| **AFRICA** | In Africa, the catastrophic **Libya floods in September 2023 marked record rainfall in 40 years in city** of Derna with approximately 400 mm in 24 hours and caused failure of the two dams — Al-Wadi Derna dam and the Derna Dam. Africa experienced highest displacement induced by floods with more than 460,000 in Somalia and 240,000 people in Ethiopia. |
| **EUROPE** | Southeast Europe experienced **"omega" weather system** in September 2023 which led to catastrophic floods in UK, Bulgaria, Greece and Turkey. In Greece, September floods by Storm Daniel caused highest daily rainfall ever recorded (754 mm) in city of Zagora. |
| **AMERICAS** | **USA experienced record-breaking rain in August** with tropical storm in Nevada doubling the 116-year-old record and Palm Springs receiving a year's worth of rain with 109 mm in 24 hours. Brazil experienced recurring floods between February and September with city of Sao Paulo recording the highest daily rainfall in 32 years (682 mm). |

*Figure 2.5: Flooding impacts across various regions*

## Heat and Flood Impacts

### TOKYO, JAPAN

The record-breaking heat and flooding events experienced by Tokyo city in 2023 highlights the brunt of increasing disasters in South Asia region. **Tokyo's temperature has increased by 3°C over the last 100 years due to the city's heat island effect.** Tokyo had the highest number of hospitalizations of 1,066 people during heat wave, up 460% compared to 2022. **The city faced extreme heat waves in July 2023 right after recording the highest 24-hour rainfall on record and flooding in June 2023.** The city with the world's largest storm water management tunnel faced floods again in August and September.

### CATALONIA, SPAIN

The cities in Catalonia region of Spain experienced **extreme heat waves and drought in April 2023 and floods in July 2023.** And another flood resulting from 243.4 mm of rain in Mas de Barberans (Catalonia) in September 2023, the highest in 23 years.

### CALIFORNIA, USA

In California, daily high temperature records were broken in several cities in July 2023, including Anaheim, Sacramento, Redding, Merced, and Palm Springs. The cities in the same region **faced record-breaking rainfall in August 2023, a month after a record-breaking heatwave,** induced by tropical storm Hilary with 62.992 mm precipitation in 46 years in Downtown Los Angeles. New York city in USA experienced both flooding and heat waves in September 2023 and the whole country faced record-breaking heat and rainfall in parts of the nation.

### ALGIERS, ALGERIA

Algiers, Capital city of Algeria, set a record high of 48.7°C on July 2023 amid a heat wave that impacted the whole Western Mediterranean region resulting in **interrupted water supply, overloading power grids and power cuts and a wildfire claiming 34 lives.** The same city faced devastating flash floods in September 2023.

### NEW DELHI, INDIA

New Delhi, the capital city of India, experienced **heat waves from March to April 2023 and recorded the highest rainfall in a single day after three months in July 2023, breaking a 40-year record.** The flooding caused Yamuna River flowing through the city to rise to 208.48 meters breaking a 45-year record. About **25% of the city's water supply was impacted** due to the closure of three major water treatment plants. Flooding at the interstate bus terminal disrupted public transportation.

*Figure 2.6: Cities across various regions that were impacted by both heatwaves and floods*

### 2.2.2 Urban Infrastructure and Climatic Hazards

Extreme climate hazards magnify disaster risk, asset loss, and service disruption, while existing infrastructure may lose its functionality. The damage or disruption of any infrastructure in the city will also create compounding risks and cause widespread transboundary disruption in services.

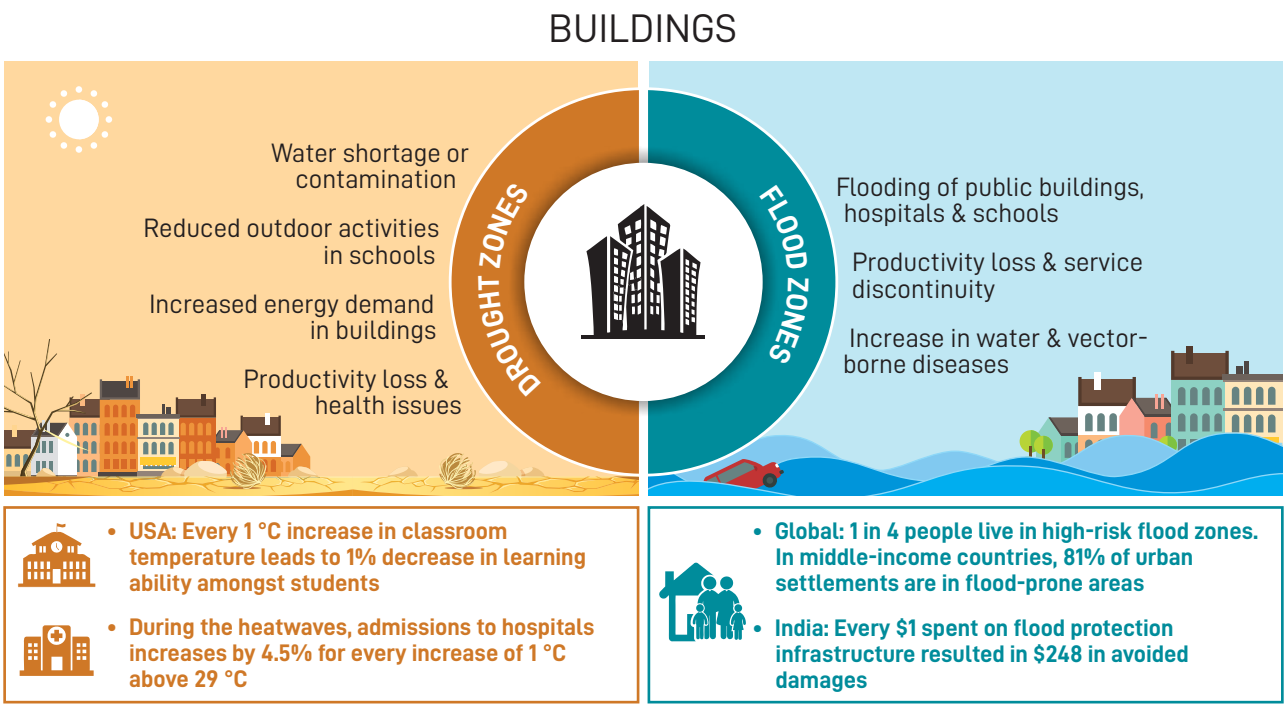



*Figure 2.7: Impacts of extreme heat and floods on buildings*

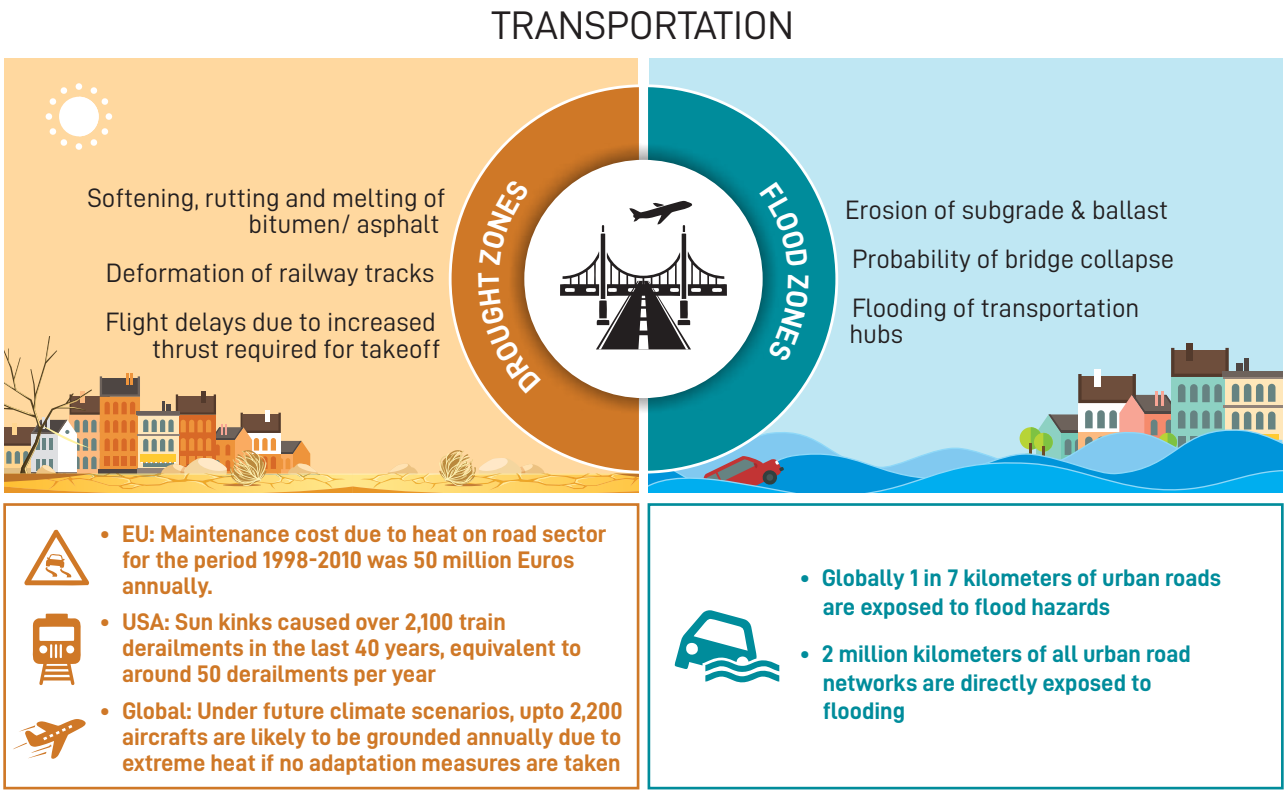



*Figure 2.8: Impacts of extreme heat and floods on transportation infrastructure*

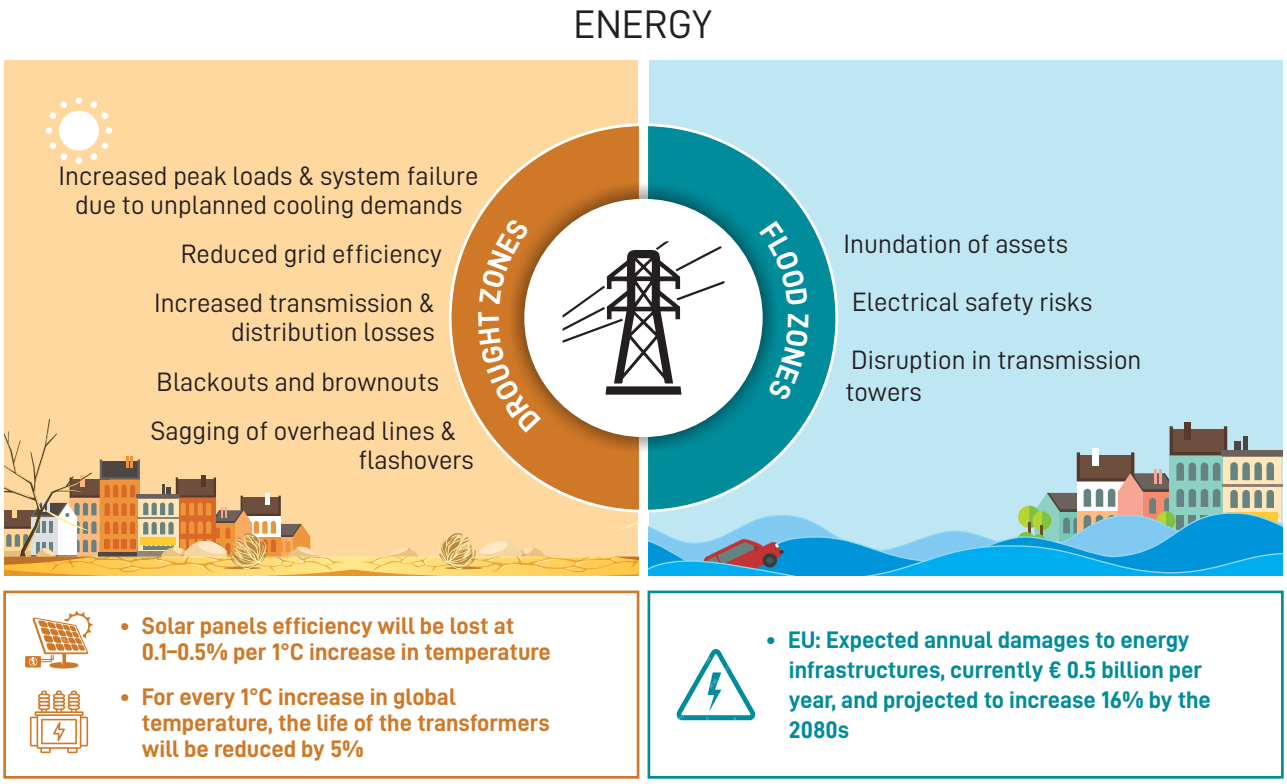



*Figure 2.9: Impacts of extreme heat and floods on energy infrastructure*

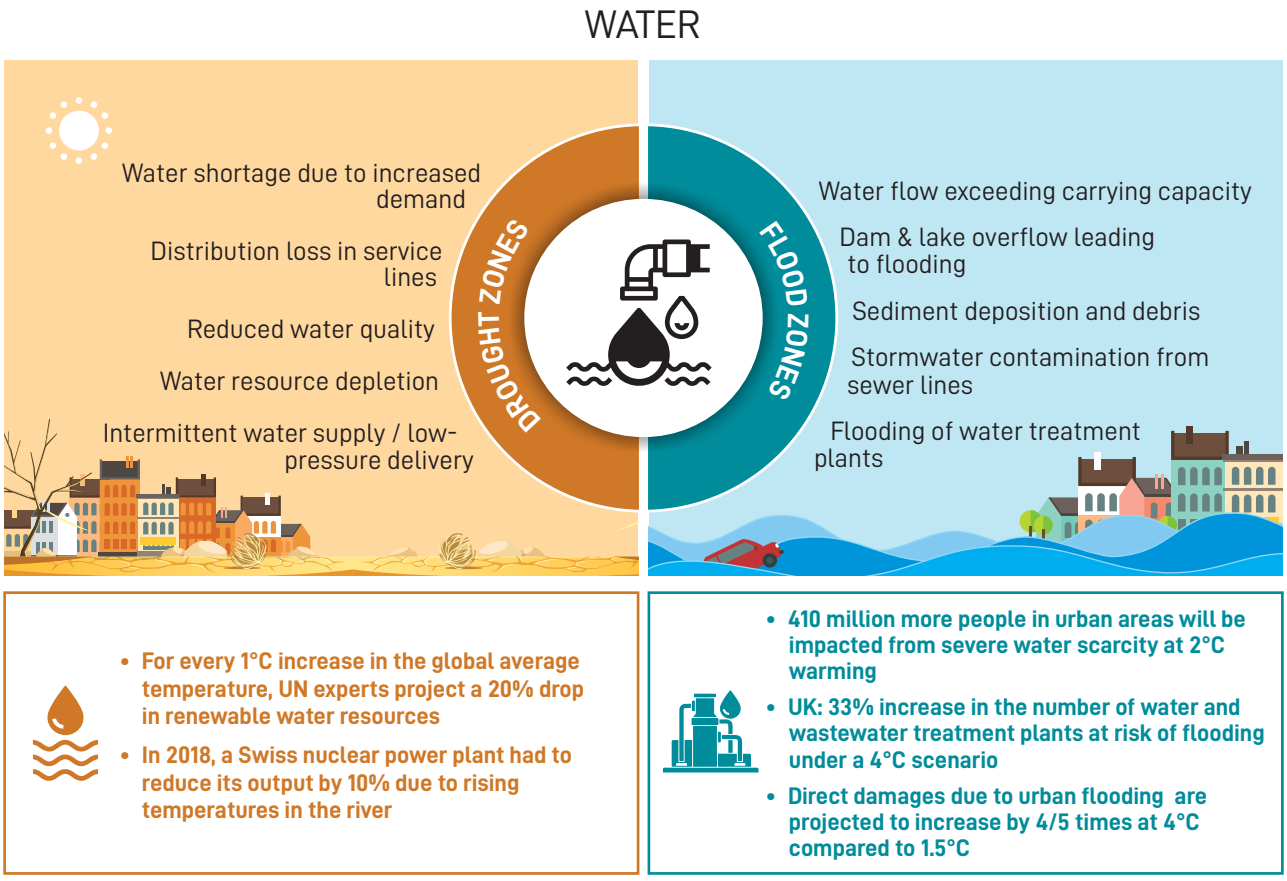



*Figure 2.10: Impacts of extreme heat and floods on water infrastructure*

## 2.3. Urban Infrastructure Resilience

UN-Habitat defines urban resilience as "the ability of any urban system, with its inhabitants, to maintain continuity through all shocks and stresses, while positively adapting and transforming toward sustainability." (UN Habitat, 2022).

**"Disaster Resilient Infrastructure (DRI) refers to Infrastructure systems and networks, the components, and assets thereof, and the services they provide, that are able to resist and absorb disaster impacts, maintain adequate levels of service continuity during crises, and swiftly recover in such a manner that future risks are reduced or prevented." (CDRI, 2023a) .**

Infrastructure resilience should be evaluated using the lens of resilient infrastructure and infrastructure for resilience. Resilient infrastructure refers to infrastructure that can absorb, rebound, and adapt to hazard events and shocks. Resilient infrastructure must be flexible and adaptive to accommodate changing demographic patterns. **Infrastructure for resilience, on the other hand, refers to infrastructure that supports broader social and economic or systemic resilience (CDRI, 2023a).**

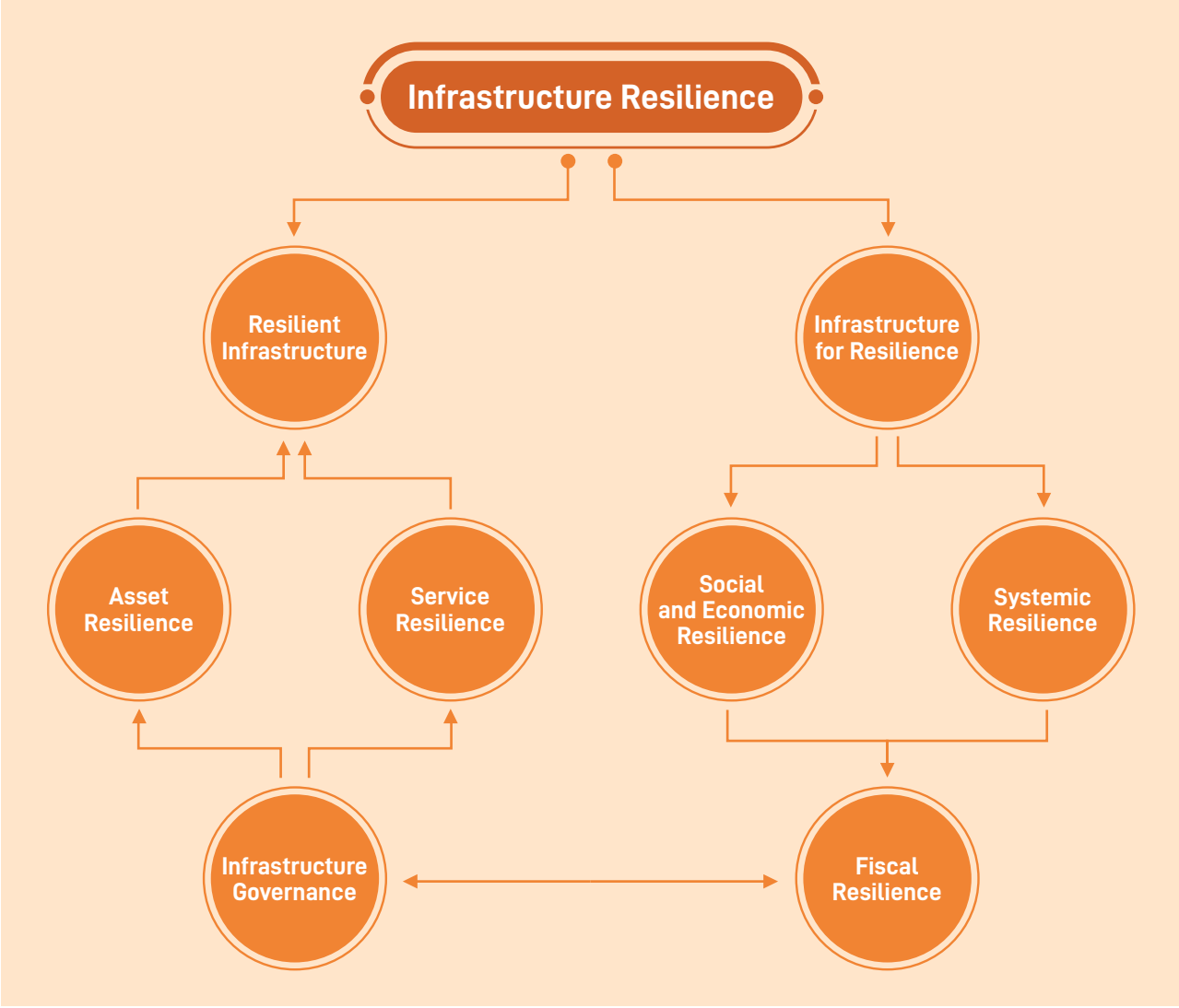


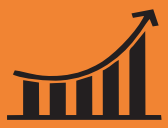

*Figure 2.11: Dimensions of Infrastructure Resilience Source: (CDRI, 2023a)*

In cities, various systems like buildings, nature, and social services are interconnected in complicated ways, planned and unplanned. For future cities to thrive, they need to focus on being strong economically, socially, and environmentally. This means having solid financial plans, social safety nets for everyone, investing in green initiatives to combat climate change, and working closely together at different levels of government to face challenges together. This approach, highlighted by (UN Habitat, 2022) , is the foundation for resilient cities.

### Need for Infrastructure Resilience

Enhancing urban infrastructure resilience aligns with the Sustainable Development Goals (SDGs), notably SDG 6 on clean water and sanitation and SDG 11 on sustainable cities and communities. The Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 underscores the importance of safeguarding critical infrastructure. Failure to safeguard infrastructure leads to economic losses. For instance, disrupted road networks post-disaster hinders aid efforts, diverting funds from essential services to reconstruction. Indirect losses, often surpassing direct ones, pose a significant threat, particularly in lower-income countries. **In 2019, global floods caused $46 billion in losses and claimed 4,500 lives,** exemplifying the toll of natural hazards (WEF, 2022).

With 60% of new urban settlements planned by 2050, embedding resilience in their design and execution is pivotal (UN DESA, 2019). A report by the Coalition for Urban Transitions emphasises the economic potential of sustainable cities. By 2050, **investing in inclusive urban spaces could generate a staggering economic dividend of $24 trillion, creating 87 million jobs by 2030 and 45 million jobs by 2050,** promising a sustainable future for cities worldwide.



Inaction on resilient infrastructure could cost cities
$314 billion annually by 2030,
rising from $250 billion today (World Bank Group, 2016).

**In LMICs, inadequate infrastructure management incurs over $390 billion in annual losses for households and businesses (Hallegate et al., 2019). The cost of inaction over a decade may reach a staggering $1 trillion.**

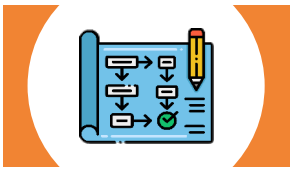
Investment in urban infrastructure resilience yields economic dividends. According to the World Bank's 2019 report, every **$1 invested in resilience saves $4 in post-disaster scenarios.** Building resilient infrastructure not only creates economic opportunities but also ensures consistent urban services during disasters, minimizing economic losses.

### Infrastructure Adaptation for Risk Reduction

In the light of increasing climate hazards and their impacts on infrastructure, the imperative to adapt urban infrastructure for risk reduction cannot be overstated. This section delves into the key approaches for infrastructure adaptation and risk reduction in urban areas.


*Figure 2.12: Infrastructure adaptation measures*

## Network-based Planning



Strategic urban and territorial planning plays a pivotal role in averting the social, economic, and environmental risks associated with burgeoning urban growth and escalating vulnerability to disasters and climate shifts. By employing sophisticated land use planning tools such as **zoning regulations, form-based codes, and the promotion of compact mixed-use development, cities can mitigate future challenges.** Emphasising urban greening, sustainable design of vital infrastructure, and resilient buildings aids in managing urban flooding and adapting to rising temperatures.

Adopting **risk-informed land use planning and stringent enforcement practices is key.** These measures prevent infrastructure investments in hazard-prone zones and protect ecosystems from degradation. Additionally, robust building regulations not only guide new urban development but also safeguard existing assets, substantially reducing losses and damages caused by both natural and chronic hazards. Through these prudent strategies, cities can fortify their foundations against unpredictable challenges and secure a sustainable future.

LULC-based planning » Network-based planning

- Integrating heat and flood resilience in urban planning
- Risk-based land use planning
- Integration of grey, blue and green infrastructure
- Implementing district cooling systems

**Conventional planning approach**

*Figure 2.13 a: Conventional Planning approach*

**Planning approach for cities of tomorrow**

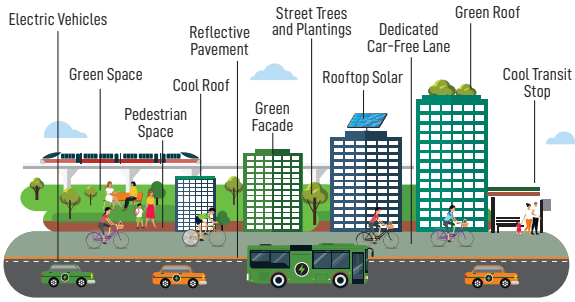



*Figure 2.13 b: Planning approach for cities of tomorrow*

## Data-informed Decision Making

Data is an imperative tool in decision making for city governments and urban professionals as it provides insights into risks (exposure, hazard, and vulnerability) on urban environment and infrastructure systems. It is the initial step in identifying and estimating risk to urban infrastructure. **Risk assessment using regional and granular urban data provides vital insights for zoning and strategies to integrate resilience in urban infrastructure design and planning** (CDRI, 2023a).

Access to real time and historic data (satellite, aerial, drone and IoTs) is instrumental in taking timely and informed action for risk adaptation and mitigation measures. Tailor made data for heat and floods, in the form of high-resolution imageries, infrastructure asset maps, blue/green infrastructure maps, damage information through SAR, etc., can accelerate adaptation actions. **Data platforms will aid cities in collating information, geospatial visualization, and its interpretation into actionable steps for actions.**

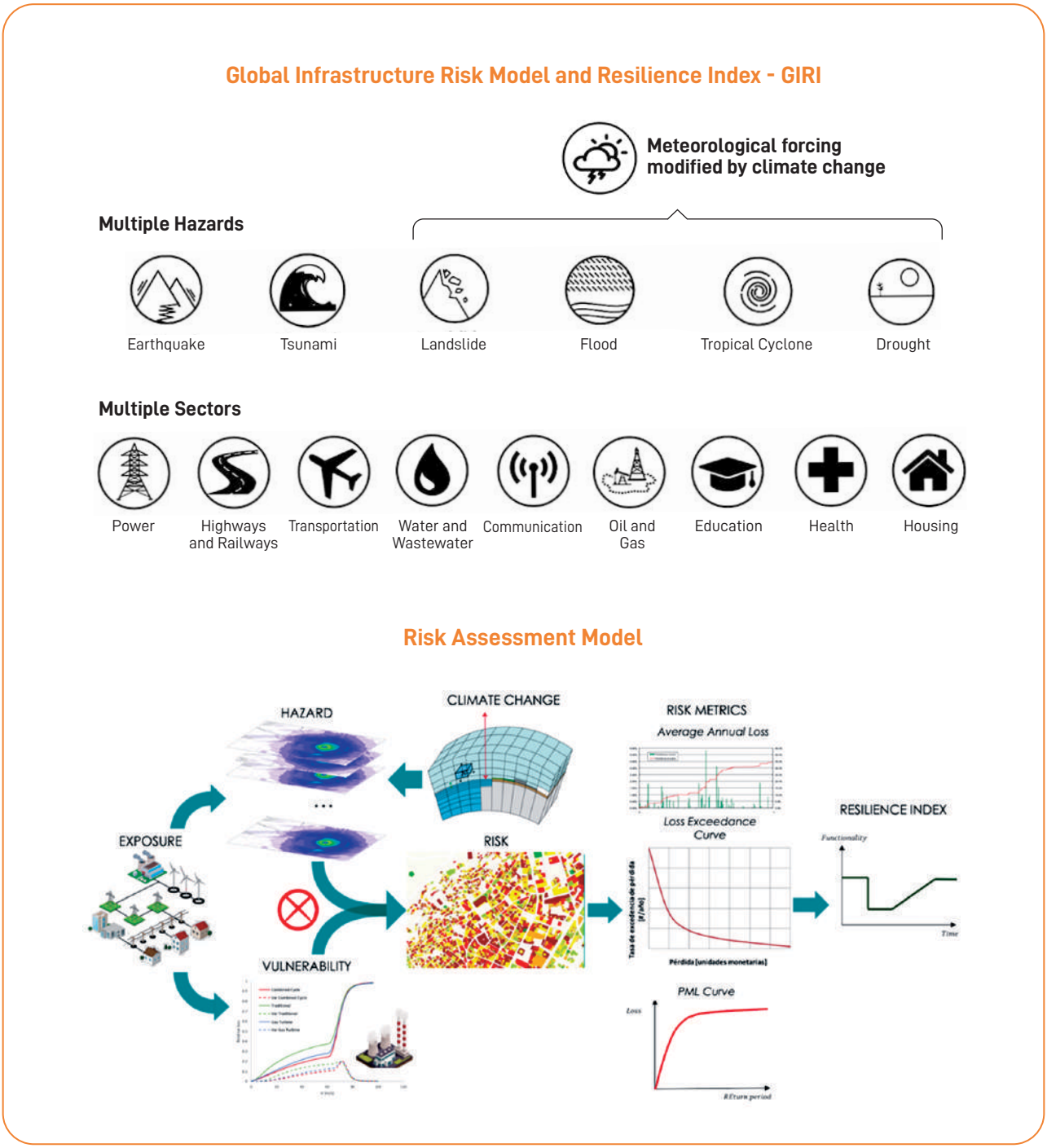




*Figure 2.14: CDRI's Global Infrastructure Risk Model and Resilience Index (GIRI), (CDRI, 2023a)*

## Nature-based Solutions (NbS)

Green infrastructure emerges as a cornerstone of urban resilience, offering multifaceted benefits to cities. **Initiatives such as green roofs, parks, tree planting, and urban wetlands play a pivotal role in mitigating heat stress by regulating city air temperatures.** Furthermore, they synergize with drainage systems by curbing surface runoff and enhancing infiltration, thereby bolstering flood management efforts.

The conservation and revitalization of natural elements like mangroves, wetlands, and forests provide invaluable advantages. Not only do these efforts reduce water treatment costs, but they also fortify cities against the challenges of droughts and floods (Samantha, Liz, & Marlena, 2023). **By harnessing the power of green infrastructure, cities can fortify their defenses, ensuring a sustainable and resilient future.**


*Figure 2.15: Integration of NbS across geographies and scales*

## Standard Operating Procedures (SOPs) for Heat and Water Stress Management

Seamless service continuity of urban infrastructure depends on the SOPs adopted during disasters. While there are existing SOPs for various shocks, **it is crucial to have separate SOPs for managing infrastructure during periods of heat and water stresses.** Creation of risk-tailored SOPs for different facets of urban infrastructure including utilities (transport, water, power), district cooling systems, city-level cooling centres, flood shelters and upkeeping of critical buildings (hospitals, schools, public) is important to ensure effective management and resilience of infrastructure during emergencies and ongoing challenges.

Only for shocks » Differentiated SOPs for shock and stress

- Standard Operating Procedures (SOPs) for transport, water and power utility operators during heatwaves
- District cooling systems
- City-level cooling centres/flood shelters
- SOPs for school, hospital and public building managers

## Early Warning System (EWS) for Infrastructure Managers

Early warnings and alerts are essential tools for infrastructure managers and critical systems operators to enhance safety and resilience in face of emerging threats. **Early warnings can help in building redundancy into critical systems and infrastructure and minimize the risk of single point failure** thereby increasing resiliency of infrastructure to withstand a variety of threats. While existing EWS are largely community-focused, more contextual warnings for various infrastructure systems are required for Infrastructure managers and critical systems operators to respond promptly to emerging threats, potentially preventing disasters, or reducing their impacts. In other cases, alerts enable proactive maintenance and repair, reducing downtime and economic losses. **In critical sectors like healthcare, timely alerts can save lives by ensuring availability of essential services during emergencies.**

Community focused warnings ✚ Infrastructure managers/owners focused warnings


According to the Global Commission on Adaptation,
just 24 hours notice
**of an impending hazardous event can reduce damage by 30%.**

Investing just US$800 million
in EWS in developing countries would
**prevent losses of**
**$3 to $16 billion annually.**

## Summary

Multifaceted challenges and nuances of urban development underscore the need for risk-informed and strategic planning, effective governance, enhanced technical expertise and institutional frameworks, and essential technological infrastructure and tools in diverse urban settings. Extreme events arising from climate variability, along with compounded hazards and underlying vulnerabilities, have disrupted energy production, increased waterborne infections, and amplified socio-economic repercussions in various parts of the globe. These have also magnified disaster risk, asset loss, and service disruption. Hence, investing in resilient infrastructure is imperative – it not only creates economic opportunities, but also ensures consistent urban services during disasters and minimizes economic losses.

*Photo by MyCreative on Shutterstock*

CHAPTER 3

# CDRI's Urban Infrastructure Resilience Programme

## 3.1. CDRI Mandate and Value Proposition

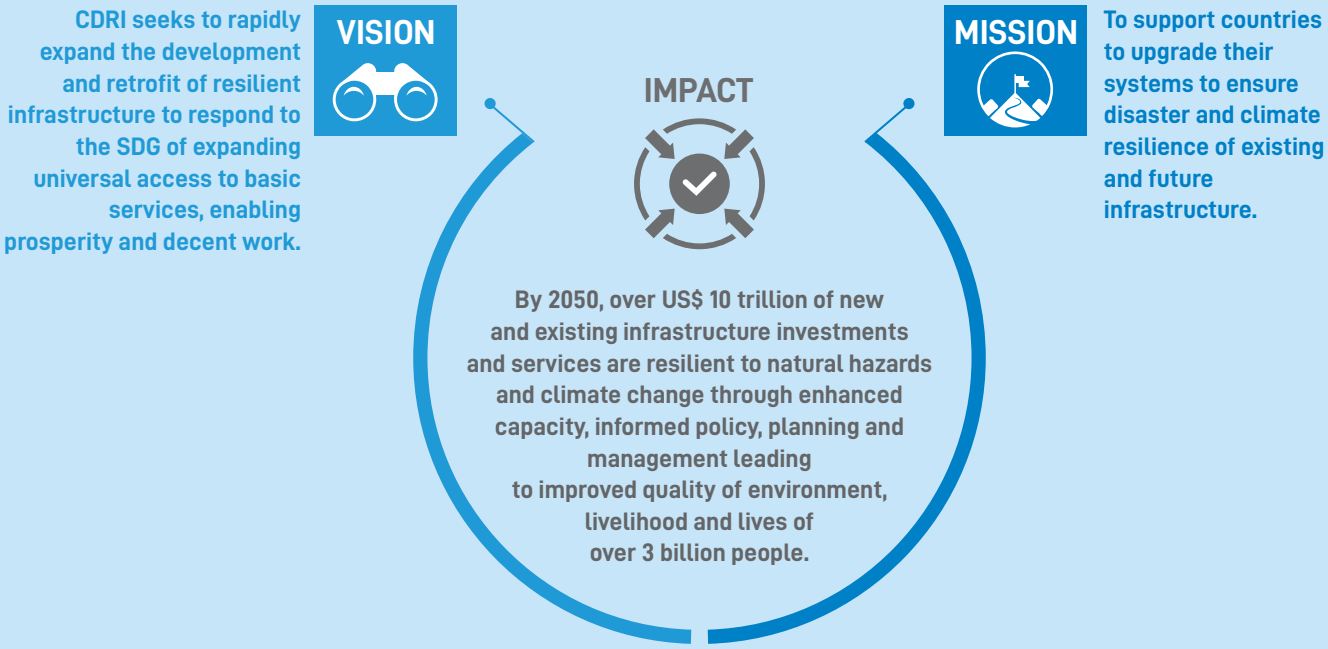



*Figure 3.1: CDRI's vision, mission and impact*

As a global partnership, **the Coalition aims to ensure that the investments of its members and partners are aligned and well-coordinated in support of the shared ambition of disaster and climate resilience of new and existing infrastructure.** The two unique yet interconnected roles that CDRI shoulders in this direction are that of a strong coalition driving collaborative Disaster Resilient Infrastructure (DRI) action and a solution-focused centre of excellence for DRI.

### 3.1.1 Strategic Outcomes - 2026

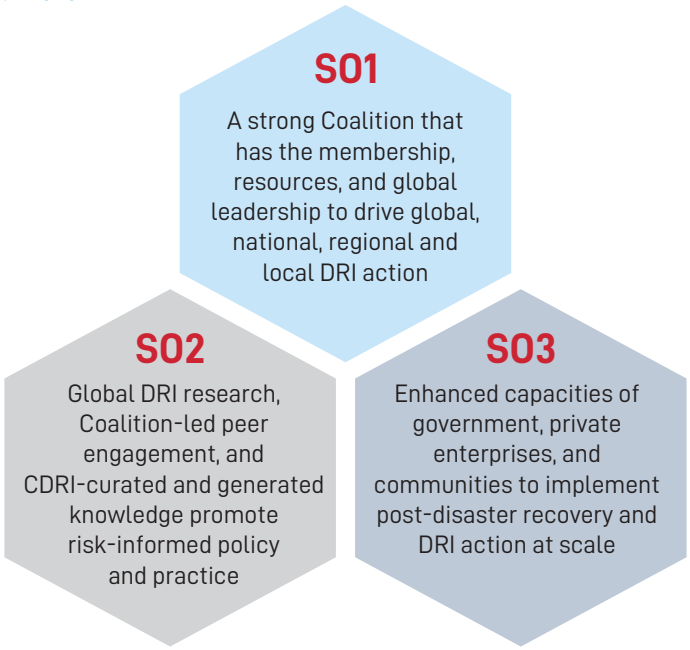



*Figure 3.2: Strategic Outcome*

## 3.2. CDRI's Urban Infrastructure Resilience Programme (UIRP)

Aligned with Strategic Outcome 3, CDRI's **Urban Infrastructure Resilience Programme (UIRP) aims to enhance urban livability by promoting resilient infrastructure planning and implementing data-driven decision-making processes to manage urban shocks and stresses.** UIRP initial work will focus on climate change-related hydro-meteorological challenges, such as **extreme flooding, water scarcity, and heat,** which are anticipated to significantly impact urban areas and populations. These challenges will disproportionately affect crucial services and urban development, especially vulnerable communities in LMICs and SIDS. The urgency of addressing these issues in these regions highlights the imperative for immediate and targeted action.

### Approach

The inception phase of the UIRP was marked by a meticulous and thorough approach. The initial step involved an in-depth landscape research endeavor. This extensive research was aimed at unpacking the multifaceted impacts of extreme heat and floods on urban infrastructure. It included analysis of not only the immediate challenges but also the potential long-term trends. We delved into existing adaptation solutions, examining their effectiveness and feasibility in diverse urban settings. Simultaneously, **efforts were made to meticulously identify the current data and information challenges faced by urban planners and managers.** This process formed the basis of identifying developmental needs and strategic areas of possible intervention.

In parallel, efforts were made to meticulously document and map the ongoing initiatives spearheaded by diverse organizations and stakeholders in the field of urban climate change adaptation. These efforts ranged from local grassroots projects to international initiatives, each contributing a unique approach to building urban resilience. Understanding these existing initiatives was crucial, as it allowed for building upon successful models and avoiding redundancy in CDRI's UIRP initiatives.

These findings then served as the foundation for a series of intensive stakeholder consultations. These consultations were designed as interactive platforms, bringing together a **diverse array of stakeholders including Member Countries, partners, multilateral and bilateral organizations, city networks, multilateral development banks (MDBs), academic institutions, and non-governmental organizations (NGOs).** The discussions were not confined to formal settings but took various forms, such as dynamic panel discussions, in-depth roundtable sessions, hands-on interactive workshops, and individual consultations. **Engaging with over 60 stakeholder organisations provided a wealth of perspectives,** enriching the understanding of the challenges faced by urban communities and identifying the opportunities that lay ahead.

Through these comprehensive interactions, a nuanced understanding emerged, capturing not only the complexities and obstacles within the realm of urban resilience but also potential pathways where the focus will be needed. The synthesis of these research efforts and stakeholder engagements laid the groundwork for the UIRP's strategic framework, ensuring a holistic and inclusive approach to enhancing urban infrastructure resilience.

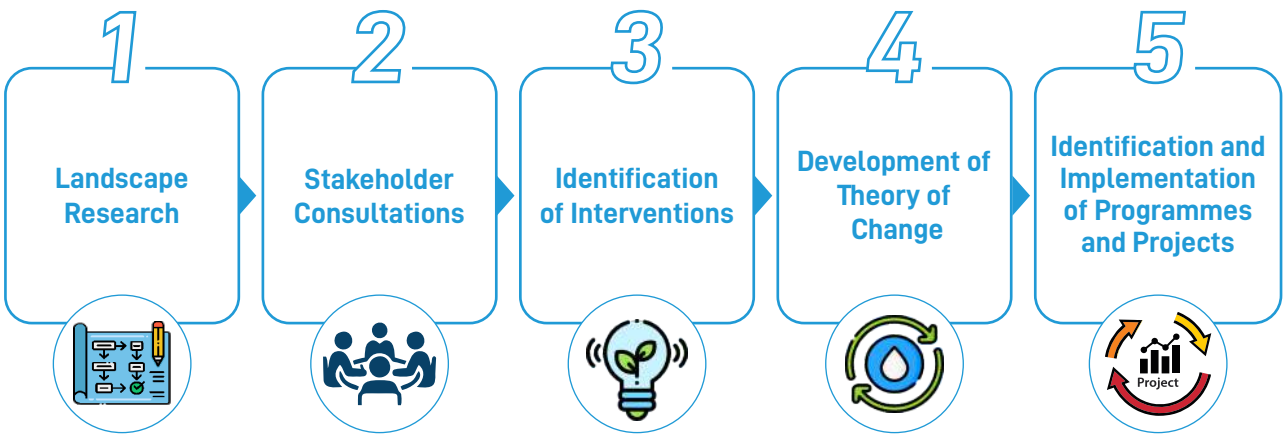



*Figure 3.3: Urban strategy development process*

## CONSULTATIONS

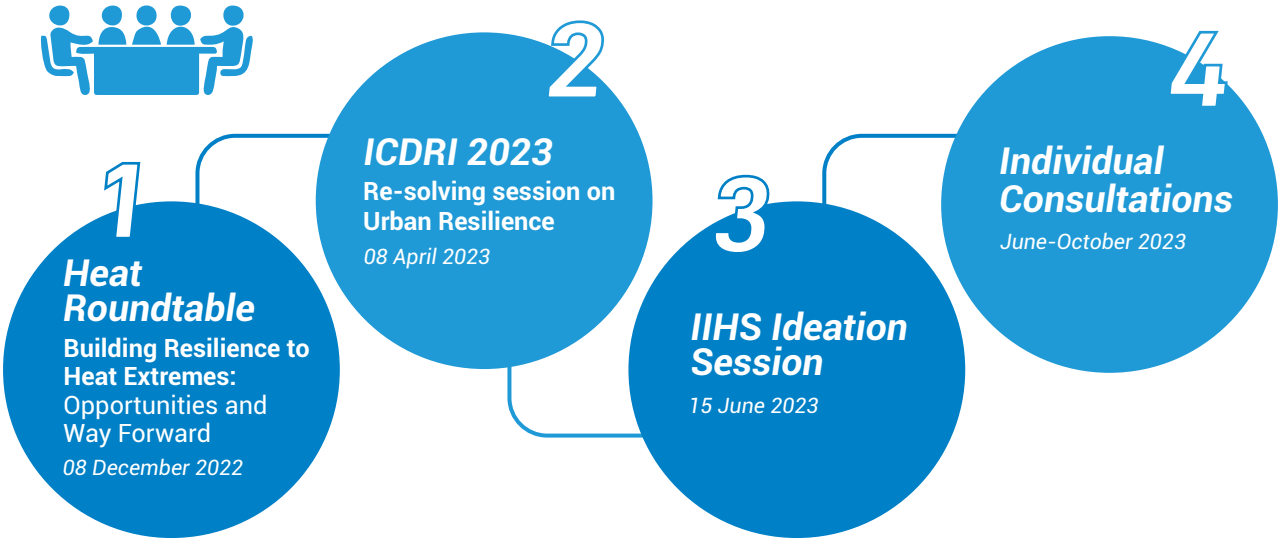



*Figure 3.4: Types and timeline of stakeholder consultations*

## STAKEHOLDERS

60+ Consulted

### Multilateral

- ADB
- EIB
- UNDP
- UNDRR
- UNEP
- UNESCAP
- WHO
- World Bank

### Bilateral/Government

- AFD
- Australian Water Partnership
- Bangladesh
- Dominican Republic
- EU
- GCoM
- GIZ
- IMD
- Infrastructure Canada
- Madagascar
- Mission Innovation
- MoHUA
- NDMA
- Netherlands/NWO
- NIUA
- SDC
- UK/FCDO
- USAID

### City Networks

- ARA
- Atlantic Council
- C40
- ICLEI
- Resilient Cities Network

### Educational/Research

- Ahmedabad University
- Arizona State University
- CEPT
- Deltares
- Harvard University
- IIED
- IIHS
- IIPA
- IISC
- IIT Mumbai
- Nagoya University
- NIDM
- PHFI
- UCL
- University of Washington

### INGO

- CIFF
- NRDC
- RMI
- SEEDS
- WRI
- WWF

### NGO-India

- AEEE
- CEE
- CEEW
- C-STEP
- MHST

### Private Sector

- Artha Global
- Deloitte
- Miyamoto International
- Planet
- Royal Haskonings (RHDV)

*Figure 3.5: List of organizations consulted*

**The consultations resulted in valuable findings which underscored the requirements for technical support, robust data and tools, capacity enhancement, and the formulation of Standard Operating Procedures (SOPs) and guidelines. The pressing need for immediate action in cities within LMICs was a unanimous consensus reached during these stakeholder discussions** and also aligning with the recommendations outlined in CDRI's Strategic Work Plan (SWP) 2023-2026.

Building upon the insights garnered from these consultations, a comprehensive Theory of Change (ToC) for the programme was meticulously developed. This ToC is expected to serve as the guiding framework for the detailed formulation of programmes and projects tailored specifically for cities in LMICs. The initiatives aligned to ToC will eventually address the needs identified, ensuring a targeted interventions which will effectively enhance urban infrastructure resilience.

## 3.3. Theory of Change

The Theory of Change (ToC) for the programme delineates potential areas of intervention identified within the Urban Infrastructure Resilience Programme (UIRP), paving the way for the development of detailed programmes and projects. This ToC explains how these initiatives will synergize, producing outcomes that contribute significantly to the intended impacts. Serving as a strategic blueprint, it guides CDRI's UIRP in program development, facilitating collaborations, and advocating for the realization of **the overarching goal: Enhanced Urban Infrastructure Resilience across LMICs.** This structured representation is anticipated to foster a robust alignment with ongoing CDRI efforts, ultimately leading to the bolstering of urban infrastructure resilience.

**OBJECTIVES**

**City infrastructure environment, services and systems are resilient against climate extremes through:**

IMPROVED ENGAGEMENT WITH
member countries and partner organizations

INCREASED ACCESS TO INFRASTRUCTURE FINANCE THROUGH
MDBs/ Investment Banks/ Finance Corporations

ACCESS TO DATA, TOOLS AND KNOWLEDGE BY
ULBs leading to improved design, operation and maintenance of infrastructure

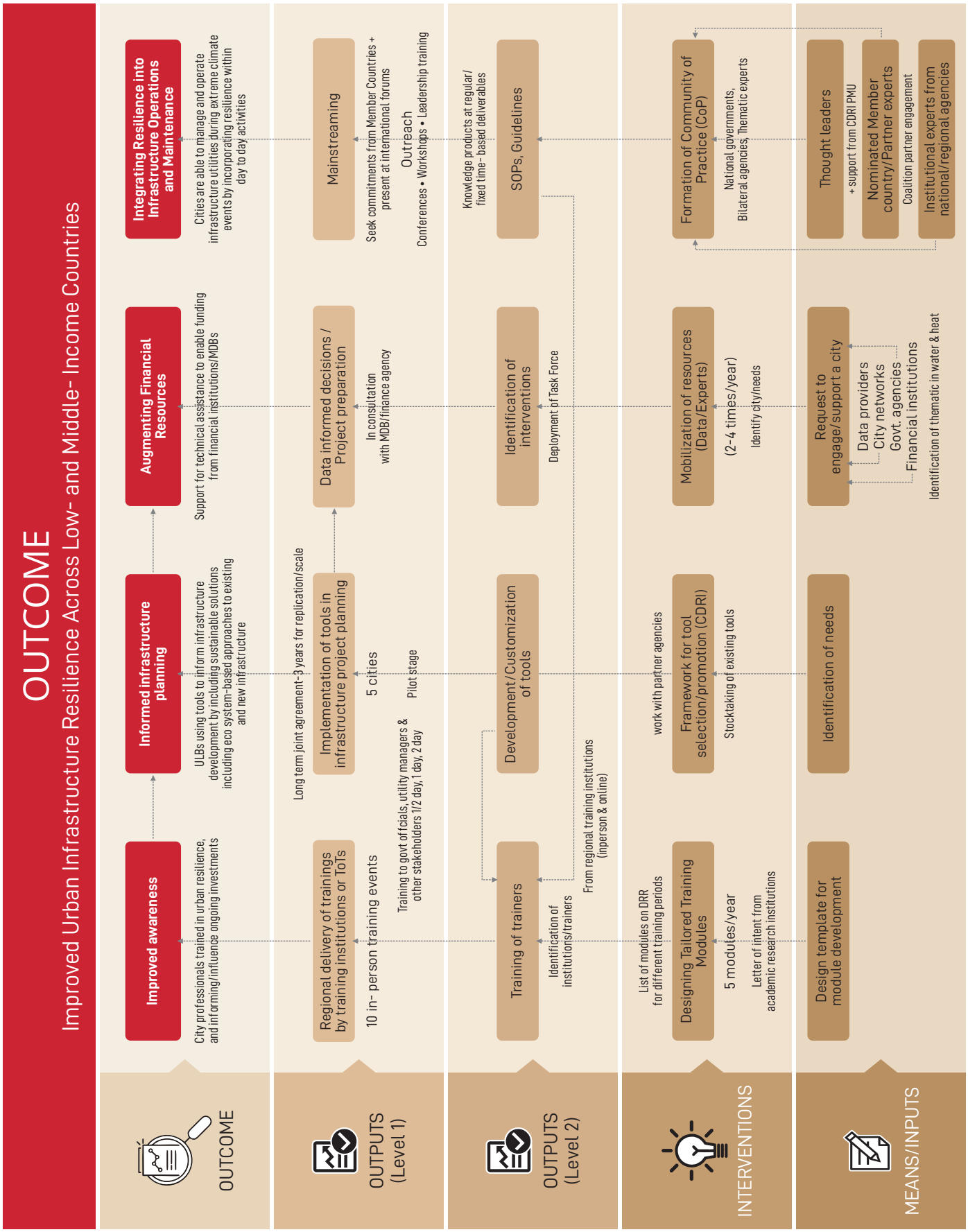



*Figure 3.6: Theory of change framework*

### 3.3.1 Objectives of Urban Infrastructure Resilience Programme

To achieve the overarching goal of improved urban resilience in LMICs, CDRI has identified with three objectives which form the building blocks of the urban strategy.

**City infrastructure environment, services and systems are resilient against climate extremes through:**

**Improved engagement with Member Countries and Partner Organizations**

**Increased access to infrastructure finance through MDBs/investment banks/financing corporations**

**Access to data, tools and knowledge by Urban Local Bodies (ULBs) leading to improved design, operation, and maintenance of infrastructure.**

These objectives will be achieved through four intervention pillars which are mutually reinforcing. Each pillar includes a set of interventions envisioned as building blocks for achieving the UIRP's outcomes as represented in the ToC Framework.

*Photo by Sergey Varygin on Shutterstock*

## 3.4. Pillars of Intervention

Four key interconnected pillars of interventions and outcomes emerge as the foundation of the UIRP


**Outcome 1 - Improved Awareness and Capacities**

To strengthen urban resilience, a fundamental shift in mindset and practices among decision-makers and practitioners is imperative. CDRI's Urban Infrastructure Resilience Programme (UIRP) aims to equip professionals with expertise in urban disaster infrastructure resilience, empowering them to influence ongoing investments in urban areas. The focus of this pillar will be towards raising awareness among key stakeholders.

### STRATEGIC APPROACH TO ACHIEVE OUTCOME 1:

**Designing Tailored Training Modules:** CDRI will help in customizing and scaling up specialized modules dedicated to urban infrastructure resilience and Resilient DRI. These modules will be meticulously designed, accommodating various training periods. Collaboration with academic and research institutions in its customisation will ensure the modules are comprehensive and relevant to the infrastructure planners, implementors and operators.

**Training of Trainers (ToTs):** To ensure effective dissemination of the developed training modules, CDRI will identify institutions or experts from regional training establishments. These professionals will be trained as trainers to cascade knowledge within their respective regions.

**Diverse Training Delivery:** Training sessions will target government officials, utility managers, and other pertinent stakeholders. CDRI will offer flexible training formats, catering to diverse learning needs. Sessions will be designed for in-person as well as online delivery, ranging from concise half-day sessions to more extensive 1 to 2 days programs.

**Regional Collaborations:** CDRI will establish collaborations with regional training institutions to facilitate the delivery of training programs. These partnerships will enable the targeted training of professionals, ensuring the dissemination of knowledge and expertise throughout urban areas.

By adopting this strategic approach, CDRI aims to enhance awareness, equip professionals, and facilitate a comprehensive understanding of urban resilience. Empowered professionals will be instrumental in shaping resilient urban landscapes, aligning with CDRI's overarching goal of strengthening urban infrastructure resilience in Low- and Middle-Income Countries.

### Outcome 2 - Informed Infrastructure Planning

This outcome will focus on equipping Urban Local Bodies (ULBs) with tools for informed decision-making in resilient infrastructure planning. Enhancing technological access and tools will empower cities to integrate sustainable solutions, including ecosystem-based approaches, into both existing and new infrastructure projects. Given the typical lifespan of critical infrastructure and the challenges posed by rapid urbanization, it is crucial to incorporate vulnerability and risk considerations into the design and planning processes. In this context, the development of critical and social infrastructure, guided by innovative tools, becomes essential for effective risk management and adaptation.

## STRATEGIC APPROACH TO ACHIEVE OUTCOME 2:

**Needs Assessment and Stocktaking:** CDRI, in collaboration with city networks, partner agencies, and think tanks, will conduct a comprehensive needs assessment and evaluation of existing tools. This analysis will inform the selection and promotion of tools for scaling which addresses the technological gaps and requirements specific to member countries.

Framework for Tool Selection and Promotion: A framework for selecting and promoting tools will be developed, guided by the identified data and technological needs of member countries. The potential for global scaling up or customization of tools across similar geographies will be explored, emphasizing practical on-ground impact and relevance.

**Long-term Agreements and Inclusivity:** CDRI aims to facilitate the establishment of long-term joint agreements between identified city ULBs and tool/information platform developers. These agreements will ensure inclusive access to tools for all Member Countries. The planning process will be phased, encompassing development, prototype testing, training, capacity building, and possible replication.

By adopting this strategic approach, CDRI strives to empower ULBs with decision-making tools, fostering resilient infrastructure planning. The focus on inclusivity, technological advancement, and practical applicability aligns with CDRI's mission to strengthen urban infrastructure resilience across diverse geographies and urban contexts.

### Outcome 3 - Augmenting Financial Resources

In the global landscape, financial institutions, and development agencies have pledged significant financial resources to bolster resilience efforts. However, cities, especially in developing nations, often encounter challenges in accessing these funds due to limited technical capacities to rationalise or quantify the resilience needs. This pillar will focus on addressing this challenge by providing tailored technical assistance through data and information.

## STRATEGIC APPROACH TO ACHIEVE OUTCOME 3:

**Identifying Thematic Areas:** Engaging with city networks and financial institutions, government agencies, and data providers, CDRI will identify thematic areas where resilience efforts are to be concentrated. This focused approach ensures strategic allocation of resources.

Selection Process: Government agencies, city networks, and financial institutions will be encouraged to submit requests to across identified thematic areas. CDRI will conduct a comprehensive analysis of these requests, assessing their feasibility in terms of catering to the requirement within the stipulated time and maintaining high-quality standards.

**Mobilizing Resources:** CDRI will leverage its network of member countries and partner agencies to procure the necessary spatial data including hazard, vulnerability, and risk information for the selected cities. A dedicated Disaster Resilient Infrastructure (DRI) task force will be deployed to identify specific interventions, working closely with the cities, MDBs, or financing agencies. This collaborative effort will facilitate risk-informed decision-making in the cities, leading to the augmentation of financial resources for both resilient infrastructure and infrastructure resilience across identified interventions.

By adopting this strategic approach, CDRI aims to bridge the gap between available financial resources and the need for additional financial resources for building sustainable infrastructure in cities thereby fostering the implementation of impactful, resilient projects.

### Outcome 4 - Integrating Resilience into Infrastructure Operations and Maintenance

Ensuring urban infrastructure remains functional and secure during extreme climate events demands robust operational practices. The fourth outcome centres on empowering cities to infuse resilience into their routine activities, guaranteeing infrastructure resilience even in adverse conditions.

## STRATEGIC APPROACH TO ACHIEVE OUTCOME 4:

**Cultivating a Collaborative Community:** CDRI will lead collaborative efforts to enhance Operation and Management (O&M) practices by fostering a vibrant Community of Practice (CoP). In collaboration with national governments, bilateral agencies, and thematic experts, this CoP will develop knowledge products including but not limited to standards, codes, guidelines, and Standard Operating Procedures (SOPs). Specialized CoPs, like those focusing on heat-resilient transportation hubs, will be formed based on need assessments or specific requests emerging from city governments.

**Mainstreaming Disaster Resilience:** To make resilience an inherent aspect of urban infrastructure management, CDRI will conduct extensive outreach activities. These initiatives encompass national, regional, and international events like conferences, workshops, and leadership training sessions. Active participation in global forums such as the Conference of the Parties (COPs), the G20, Quadrilateral Security Dialogue (QUAD), the Association of Southeast Asian Nations (ASEAN), and the African Union (AU) will be utilized to garner commitments and actions. CDRI's signature events, including the International Conference on Disaster Resilient Infrastructure (ICDRI), regional conferences, DRI conclaves, and technical conferences, will serve as platforms for advocacy, commitment, and partnership formation.

**Through these strategic endeavors, CDRI will embed resilience into urban infrastructure operations and maintenance. By fostering collaborative networks, encouraging knowledge sharing, and actively engaging with international platforms, CDRI will aim to advocate urban infrastructure resilience on a global scale, ensuring cities thrive in the face of future climate extremes.**

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CHAPTER 4

# Implementing CDRI Urban Infrastructure Resilience Programme

## 4.1. Strengthened Geo-Political Partnerships and Networks for Futureproofing of Urban Infrastructure

Recognising the fundamental role that active partnerships play in advancing the CDRI mission and vision, the UIRP will leverage both existing and new collaborations. These initiatives will be strategically aligned with the Sustainable Development Goals 2030, the Sendai Framework for Disaster Risk Reduction 2015-2030, and the Paris Agreement on climate change, underscoring our commitment to these global agendas. Emphasising inclusivity, our focus will be on the most vulnerable regions and populations.

Through UIRP, CDRI will initiate and support collaborative efforts that aim for common goals. By fostering synergies between programs and initiatives CDRI will optimise the utilisation of available resources. **Technical assistance will be prioritised for cities in LMICs, emphasising our commitment to supporting vulnerable communities.** A pivotal aspect of this endeavour involves strengthening existing partnerships with financing institutions and Multilateral Development Banks (MDBs) to secure substantial funding and resources on a larger scale.

## 4.2. Synergies with Other CDRI Initiatives

**The Programs will actively seek synergies with various sectoral and context-specific initiatives and programs within CDRI,** including but not limited to the Infrastructure Resilience Academic eXchange (IRAX), Infrastructure for Resilient Island States (IRIS), High Mountain Region Resilience Programme, DRI Connect platform, Health Resilience Programme, Global Infrastructure Resilience Index (GIRI) platform, and DRI Task Force. Through such collaborative approach the program will ensure a comprehensive and integrated effort across diverse sectors leading to achieving impact of significance and scale.

## 4.3. Focus On Gender, Inclusion, Vulnerable Countries and Populations

The objectives of the UIRP will align closely with the 2030 Agenda. **The initiatives are specifically crafted to advocate for inclusive, people-centerer approaches, ensuring that the perspectives and voices of those most vulnerable are not only acknowledged but catered to.** CDRI recognises the vital role of women, representing diverse backgrounds, as catalysts for change. To harness their expertise and insights in shaping climate-resilient urban infrastructure projects, CDRI is committed to providing equal opportunities for women leaders across all UIRP initiatives.

## 4.4. Development and Rollout of UIRP through CDRI's Multi-Partner Trust Fund

The UIRP will be implemented through meticulously planned projects and interventions, targeting cities across varied geographic regions and exposed to diverse risks and natural hazards. **In its initial phase, UIRP will concentrate on challenges related to extreme heat, urban flooding, and water scarcity in urban areas.** These projects will have a cross-cutting nature, addressing multiple outcomes, and will be funded through the CDRI's Multi-Partner Trust Fund, namely the Infrastructure Resilience Accelerator Fund (IRAF).

IRAF is a dedicated international multi-donor trust fund established — with the support of the United Nations Development Programme (UNDP) and United Nations Office for Disaster Risk Reduction (UNDRR) and managed by the United Nations Multi-Partner Trust Fund Office (UN MPTFO) — to support global action on disaster resilience of infrastructure systems, especially in developing countries and SIDS. The Fund will enable CDRI to achieve its mandate of resilience through risk-informed investments and infrastructure development resulting in reduced vulnerability of populations and reduced impact of extreme events and disasters on infrastructure systems. The focus of IRAF will be on technical assistance, capacity building, research and knowledge management for resilient infrastructure, including energy, transportation,

telecommunication, health, urban and other basic and social infrastructure. With an initial duration of five years, around $50 million in financial commitments have already been announced and more are expected in future. So far, commitments have been made by the Governments of India, the United Kingdom, Australia and the European Union for the next five years. Projects and interventions developed under the UIRP will also be funded under the IRAF.

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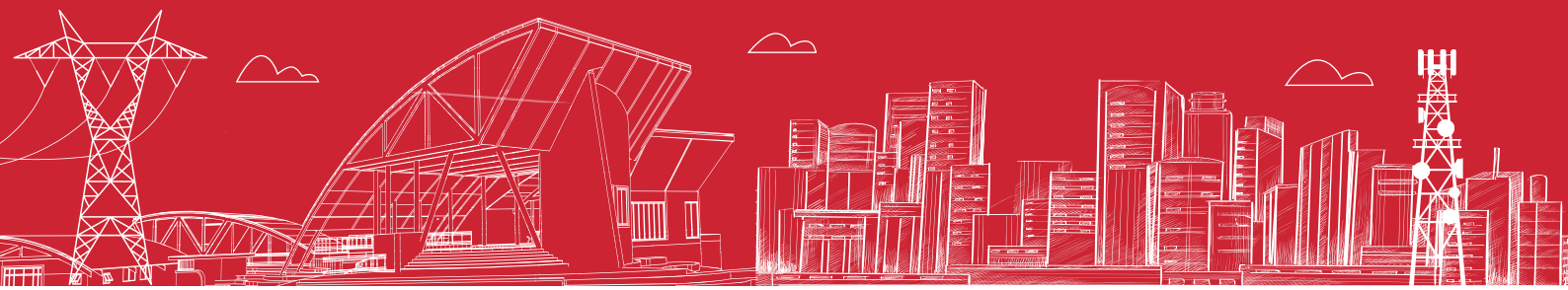

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