# DISASTER RESILIENCE INFRASTRUCTURE

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| **INTRODUCTION** | As the name implies, **disaster-resilient infrastructure include**s vital buildings, public communal facilities, transit systems, telecommunications, and power systems that are strategically designed to withstand the impact of a natural disaster like a flood, earthquake, or wildfire. | |
| | Communities building resilient infrastructure in their city or town need to analyze data to weigh the risks of potential natural disasters based on their geographic location, consider which architectural improvements will be most beneficial in their community, and organize a budget and timeline for implementing said improvements. | |
| **Recent Context** | CDRI report urges risk assessment in financial planning for disaster-resilient power systems. | |
| **Need in India to build disaster resilience** | **Breakdown of essential services** | **Power systems, telecommunications, transportation, health services**, and even cyber systems **face disruptions** due to disasters, complicating an already difficult crisis situation. |
| | | The breakdown of essential and emergency services not only **hampers relief, rescue, and recovery,** but also amplifies the risks and sometimes adds to the devastation. |
| | | **Ex:** Due to extreme heatwaves, unusually high power demand led to **frequent power cuts in Delhi** and neighbouring areas. |
| | **Economic loss** | **Early warnings and quick response** have reduced disaster casualties, but economic losses from **extreme weather events are increasing** due to increased frequency and intensity. |
| | | **Ex:** Government data show that between **2018-2023,** states together spent more than **Rs 1.5 lakh crore on dealing with the aftermath of disasters** and natural calamities. |
| | **Loss of livelihood** | **Long-term costs, in terms of livelihood losses** for example, or because of a reduction in the fertility of agricultural land, are much bigger and projected to worsen over time. |
| | | **Ex:** A 2022 **World Bank** report projected that the **decline in productivity due to heat-related stress** could take away around 34 million jobs in India by 2030. |
| | **Incorporating resilience** | Almost all the infrastructure sectors now have disaster management plans in place to prepare and respond to these events. |
| | | But **progress on this front has been slow** and a bulk of India's infrastructure remains extremely vulnerable to disasters. |
| | | **Ex: According to the Coalition for Disaster Resilient Infrastructure study in Odisha:**<br>● More than 30 percent of the distribution substations were located within 20 km of the coastline,<br>● 80 percent of the electricity poles were susceptible to high wind speeds,<br>● Also, more than 75 percent of distribution lines were installed more than 30 years ago,<br>● Do not have the capacity to withstand cyclonic winds. |
| | **Incorporation of disaster** | **India is still in the process of developing** its infrastructure. Most of the infrastructure that has been proposed to stand in India by 2030 is still to be built. |

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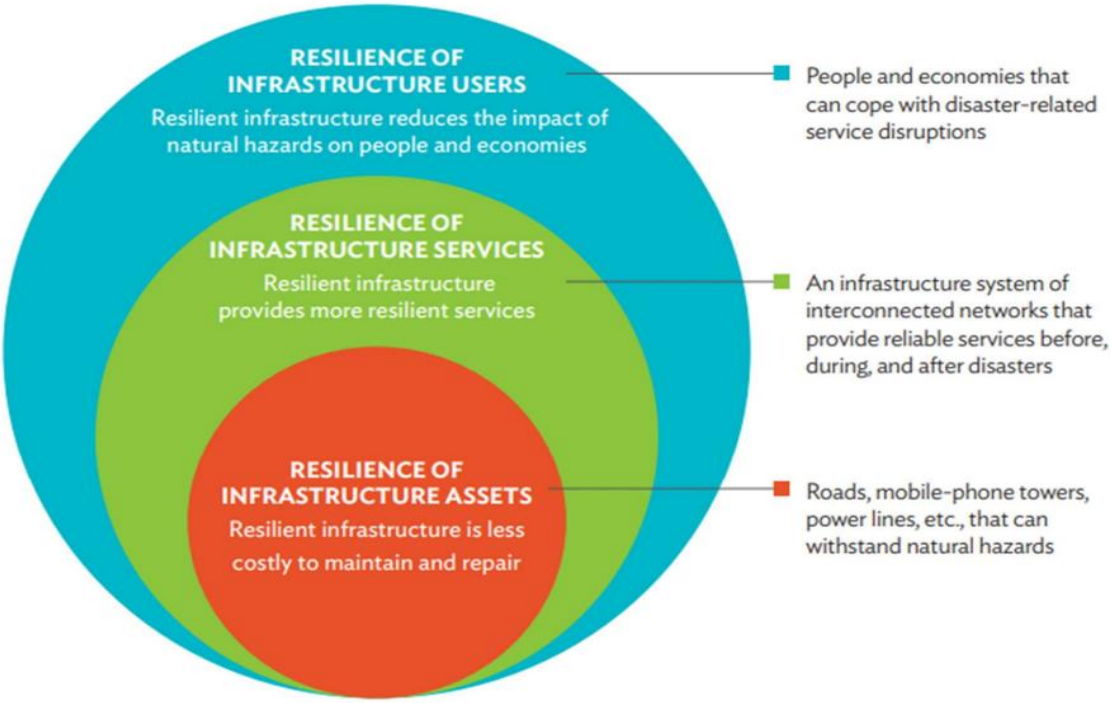
| | **resilience at building stage** | It is much **easier, and cost-effective,** to incorporate disaster resilience **at the time of building** than to retrofit these features at a later stage. |
| **A System-wide Approach to Infrastructure Resilience** |  | |
| **Working of disaster-resilient infrastructure** | **The key aspects depicting how disaster-resilient infrastructure functions are as follows:** | |
| | **Risk Assessment and Planning** | **Vulnerability Assessment:** Identification and assessment of potential hazards and vulnerabilities specific to the region where the infrastructure is planned. |
| | | **Risk Analysis:** Evaluation of the potential consequences of identified hazards and assessment of the likelihood of their occurrence. |
| | **Incorporating Resilience in Design** | **Engineering Standards:** Implementation of robust engineering standards and codes that consider the local risk profile. |
| | | **Flexible Design:** Design of infrastructure with flexibility and adaptability to accommodate unexpected stresses and changes. |
| | **Advanced Technologies** | **Early Warning Systems:** Effective deployment of early warning systems in order to provide timely alerts about imminent disasters, enabling preventive measures and evacuation. |
| | | **Smart Infrastructure:** Integration of smart technology such as sensors, monitoring systems, and data analytics to detect vulnerabilities and potential failures in real time. |
| | **Infrastructure Interconnectedness** | **Consideration of interdependencies** between different infrastructure systems (transportation, energy, water) to ensure a holistic and coordinated response to disasters. |
| | **Community Engagement and Education** | **Community Involvement:** Engagement with local communities in the planning and decision-making process to ensure that infrastructure meets their needs and is culturally appropriate. |
| | | **Public Awareness:** Educate the public about disaster risks, preparedness measures, and the role of resilient infrastructure in safeguarding communities. |

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| | **Collaboration and Partnerships** | **Multi-Stakeholder Collaboration:** Fostering collaboration between government agencies, private sector entities, NGOs, and local communities to share resources, expertise, and responsibilities. |
| | | **Policy Support:** Advocate for and implement supportive policies at local, regional, and national levels to incentivize the incorporation of resilience measures in infrastructure projects. |
| | **Post-Disaster Recovery** | **Rapid Response:** Development of plans for rapid response and recovery, including the restoration of essential services and infrastructure functionality. |
| | | **Learning from Disasters:** Conduction of thorough post-disaster assessments to understand failures and successes, enabling continuous improvement in resilience strategies. |
| **Examples of disaster-resilient infrastructure** | **Earthquake Resilient Buildings** | Buildings are designed with **seismic-resistant structures**, base isolators, and flexible materials to minimize damage during earthquakes. |
| | **Flood-Resilient Infrastructure** | **Flood barriers and levees** to prevent or mitigate flood damage. Elevated structures or buildings on stilts to minimize water exposure. |
| | **Hurricane-Resistant Structures** | Buildings constructed to **withstand high winds and storm surges.** Coastal infrastructure designed to resist the impact of hurricanes, such as resilient bridges and ports. |
| | **Wildfire-Resilient Landscapes** | **Firebreaks and defensible space** around structures to prevent the spread of wildfires. Fire-resistant building materials and designs. |
| | **Energy Infrastructure** | **Resilient power grids** with redundancy and distributed generation to ensure energy supply during disasters. Underground utility lines to reduce the risk of damage from high winds or flooding. |
| | **Critical Facilities** | **Emergency operation centers and disaster recovery facilities** are designed to remain operational during disasters. Hospitals with reinforced structures and backup power to provide uninterrupted healthcare services. |
| **Coalition for Disaster Resilient Infrastructure (CDRI)** | **Introduction** | The CDRI was established in **2019** under the leadership of the Government of India and with the **support of UNDRR.** |
| | | It is a **multi-stakeholder global partnership** of national governments, **UN agencies** and programs, multilateral development banks, the private sector, and academic institutions. |
| | **Aim of CDRI** | CDRI aims to **promote the resilience of infrastructure systems** to climate and disaster risks, thereby ensuring sustainable development. |
| | | It seeks to rapidly **expand the development and retrofit of resilient infrastructure** to respond to the **Sustainable Development Goals** imperatives of expanding universal access to basic services, enabling prosperity and decent work. |
| | **CDRI's Resilience Programmes**<br>The CDRI has initiated a number of global and state-level studies for building resilient infrastructure systems. | |
| | **Power Sector** | Power Sector Infrastructure Resilience Programme initiated a power sector resilience study with **Chile and Brazil** on systemic resilience and redundancy, and hydel power, respectively. |

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| | **Transport Sector** | The Transport Sector Infrastructure Resilience Programme is currently **focusing on airport and seaport resilience.** |
| | **Telecommunications Sector** | The Telecommunications Sector Infrastructure Resilience Programme is studying the **Indian states of Assam, Odisha, Himachal Pradesh, Gujarat, and Tamil Nadu.** |
| | **Health Sector** | The Health Sector Infrastructure Resilience Programme seeks to **promote systemic preparedness,** response, and recovery capabilities to enable the continuity of healthcare services during disasters. |
| | **Urban Sector** | The Urban Sector Infrastructure Resilience Programme has conceptualized a global study on **urban infrastructure resilience in 20 cities in partnership.** |
| | **Finance Sector** | The Finance for Resilient Infrastructure Programme has initiated a study on the **fiscal risk assessment** of power and transport sectors in four member countries (**India, Fiji, Mauritius, and Nepal**). |
| | **Infrastructure Resilience Accelerator Fund (IRAF)** | |
| | **Set up by** | The Coalition for Disaster Resilient Infrastructure announced setting up the IRAF. |
| | **Multi-donor trust fund** | It is a **multi-donor trust fund,** established with the support of the United Nations Development Programme (**UNDP**) and the United Nations Office for Disaster Risk Reduction (**UNDRR**). |
| | **Managed by** | It will be **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 S**mall Island Developing States (SIDS).** |
| | **Financial commitments** | Around **$50 million** in financial commitments have already been announced for IRAF over an **initial duration of five years.** |
| | **Significance** | IRAF will play a crucial role in equipping the Coalition to deliver improved infrastructure governance, inclusive infrastructure services, diversified knowledge, and financing for resilient infrastructure globally. |
| | **Infrastructure for Resilient Island States** | |
| | **Launched by** | **India, along with the UK launched** 'Infrastructure for Resilient Island States' (IRIS) on the sidelines of the **COP 26 climate summit** in Glasgow. |
| | **About IRIS** | The IRIS is a part of the Coalition for Disaster Resilient Infrastructure. |
| | | Under this, ISRO will build a **special data window** for Small Island Developing States (SIDS).<br>With this, SIDS will continue to get **timely information** about cyclones**,** coral reef monitoring, coast-line monitoring, etc through satellite. |
| | **Need for IRIS** | The biggest threat from climate change disasters is to the SIDS. It is a challenge to their existence. |
| | | - The **United Nations Office for Project Services report** says that around **20% of global biodiversity** is in small island countries and they are f**acing severe climate change impacts.**<br>- On the other hand, they are responsible for less than 1% of global greenhouse gas emissions. |
| | | In such countries, climate change is a **major challenge not only for the security** of their |

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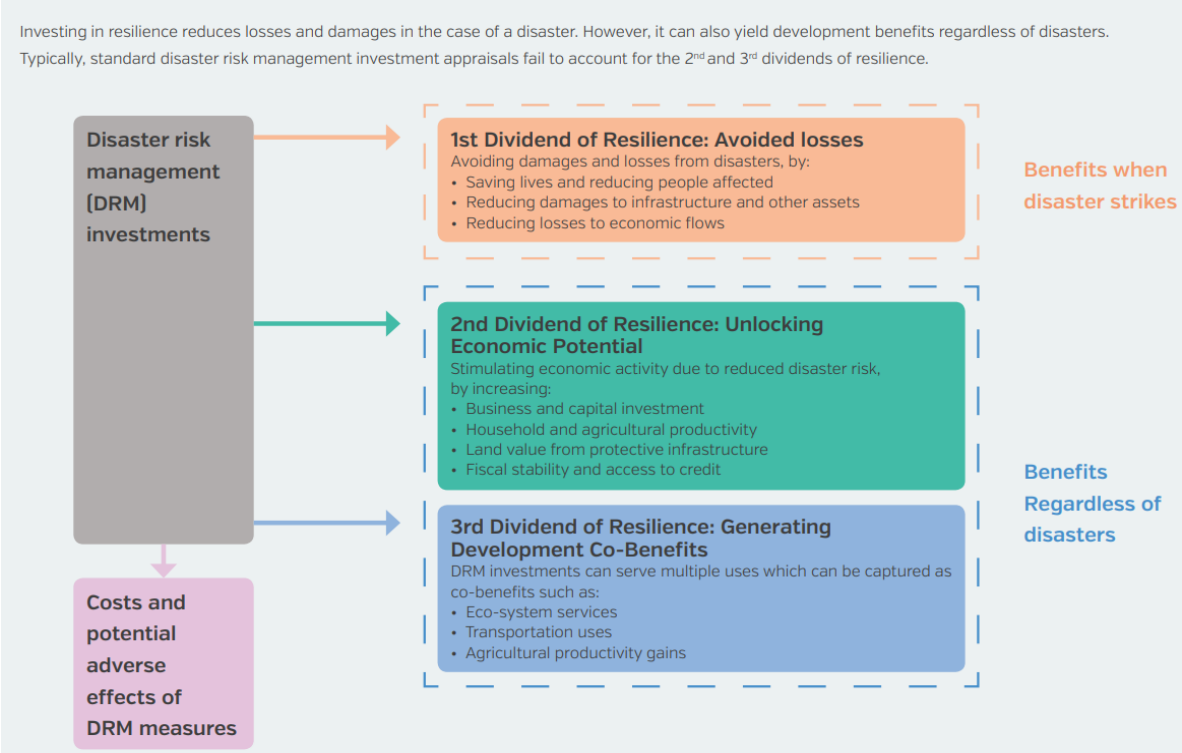
| | | lives, but also for their **economies**, such countries depend a lot on tourism, but due to natural calamities, even tourists are afraid to come there. |
| **Benefits of developing disaster resilience infrastructure** |  | |
| **Challenges** | **Diverse terrain** | - India has been **vulnerable, to varying degrees** which makes it challenging to develop a disaster resilience infrastructure. |
| | | - While on one hand, the **Himalayan region** is prone to disasters like **earthquakes** and landslides, the plain is affected by floods almost every year.<br>- The **desert part** of the country is affected by **droughts and famine** while the **coastal zone is susceptible to cyclones and storms.** |
| | **Rapid urbanisation** | **Haphazard development and unplanned urban growth** in the cities are the factors increasing the vulnerability of the urban population to the risk of disasters and it often **leads to infrastructure deficiencies.** |
| | **Lack of data** | There is **no available data on the investments** and expenditure in building climate-resilient infrastructure in India. |
| | **Prioritisation to disaster mitigation over resilience** | The **Disaster Management Act 2005** mandated the creation of Disaster Response and Mitigation Funds at the National, State, and District levels, clearly reflecting **prioritisation of disaster response and mitigation over resilience-building activities.** |
| | **Lack of funds** | There is **no mainstreaming of a dedicated disaster resilience fund.** The lack of funds specifically aimed at creating resilient infrastructure is a major roadblock to putting risk-resilience plans into operation. |
| **Way forward** | **Integrated approach** | There is a need to integrate **disaster risk reduction approaches into urban planning** and development. |
| | **Strengthening existing regulatory regime** | There is a need to **strengthen the existing regulatory regime** in the local governments, including disaster resilient building codes, and far more important is their strict implementation. |

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| | **Evolving understanding of natural hazards** | **To ensure optimal resilience in new infrastructure**, standards for design and risk management practices have to keep pace with the evolving understanding of natural hazards, as well as **advancements** in **engineering technologies.** |
| | **Proper funding** | **Massive investments** would be required for building even the most basic of essential infrastructure. |
| | | This level of investment provides a **window of opportunity** to ensure that all new infrastructure is made resilient to withstand future shocks, including those brought about by a changing climate. |
| | **Standards for operations and maintenance** | The **notion of 'standards'** needs to go beyond the structural engineering aspect of infrastructure to also include operations and maintenance. |
| | | If standards for operations and maintenance are inadequate, it can increase the impact of hazard events or even trigger new ones such as urban floods due to inadequate maintenance of urban sewage systems. |

**Mains Practice Questions**

1. What do you understand by disaster-resilient infrastructure? Why India needs to build disaster resilience in its critical infrastructure?
2. What is Coalition for Disaster Resilient Infrastructure? Mention its role in promoting disaster-resilient infrastructure in developing countries.