CDRI
Coalition for Disaster Resilient Infrastructure

EXECUTIVE SUMMARY

Global Infrastructure Resilience 2025

Capturing the Resilience Dividend

A Biennial Report from the
Coalition for Disaster Resilient Infrastructure

This Work is a product of the Coalition for Disaster Resilient Infrastructure (CDRI) as part of the second *Global Infrastructure Resilience* report (GIR 2025) and features external contributions from multiple organizations. The full report and the executive summary may be accessed at https://cdri.world/resilience-dividend/global-infrastructure-resilience-report-second-edition/. All working papers for this report (GIR 2025 Working Paper Series) are available on the official website of CDRI, accessible on the web link mentioned above. They provide detailed background material, methodologies, analyses, and case studies for each chapter of the report. The papers will be released sequentially starting November 2025 through 2026.

An online data platform enabling visualization, analyses, and downloading provisions for the results of the Global Infrastructure Risk Model and Resilience Index (GIRI) is available at https://cdri.world/giri. Updates incorporating the GIR 2025 results will be available on this platform in early 2026.

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Cover

The cover image shows annual test of the Ramspol inflatable rubber surge barrier near the village of Ens in Kampen, The Netherlands. It can be inflated during storms, stopping water from the Ketlemeer from going into the Zwarte Meer between Flevoland and Overijssel. It captures innovation and resilience in infrastructure. *Source: Getty Images*

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Testimonials

Suman Bery

Vice Chairman, NITI Aayog, Government of India

As escalating risks and the increasing intensity of disasters redefine global development, the need for collective action to forge stable and scalable pathways to sustainable growth has become more indispensable than ever. CDRI's second Global Infrastructure Resilience report (GIR 2025) arrives at a crucial moment, offering practical insights and thoughtful guidance for countries striving for growth that is both resilient and equitable.

Providing compelling evidence on the magnitude of indirect economic losses from infrastructure disruptions, it underscores that faster, comprehensive, and well-financed reconstruction, supported by strong institutional readiness, is key to shaping a world that learns to thrive through resilience. Ensuring dedicated budgets for maintenance, transparent rules for resilience financing, and targeted retrofitting of vulnerable assets is equally critical. Infrastructure agencies must be empowered with clear mandates, adequate contingency funds, and appropriate financial instruments to enable swift and complete reconstruction after disasters. Furthermore, by advancing nuanced risk assessment and leveraging technological innovation and novel approaches to scale resilience, the report outlines pathways for tangible outcomes that can drive sustained and collective progress.

Building resilience is a shared responsibility, globally and within countries. It calls for coherence between science, policy, finance, and implementation, and for deeper global cooperation and partnerships. This report provides both the evidence and the vision needed to make resilience a cornerstone of sustainable development and collective progress.

Rosa Galvez

Senator, Independent Senators Group, Senate of Canada

Building on the foundation of its inaugural edition, the second Global Infrastructure Resilience report (GIR 2025) reaffirms that resilience is not an afterthought but is central to the global adaptation agenda. By placing resilient infrastructure at the heart of this collective ambition, the report envisions a future that is equitable, inclusive, and grounded in protecting those most at risk. Its renewed focus on coordinated and forward-looking policies, innovative engineering and technological solutions, and clear standards and regulations that embed resilience across all stages of planning and implementation, sets a clear direction towards stronger and more adaptive systems.

Equally important are the often-overlooked investments in maintenance, retrofitting, data systems, and capacity building, which quietly but powerfully reinforce the infrastructure that sustains communities and economies. These are reminders that infrastructure resilience must follow a collaborative and systemic approach, evolving with foresight and guided by the principles of inclusion and justice, to ensure that knowledge translates into meaningful action.

CDRI's leadership through this report exemplifies the power of shared purpose and vision. I strongly commend this effort, which stands as a powerful testament to how policy, innovation, and collective resolve can drive transformative change and secure a resilient and sustainable future for all.

Kamal Kishore

Special Representative of the United Nations Secretary-General (SRSG) for Disaster Risk Reduction, and Head of the United Nations Office for Disaster Risk Reduction (UNDRR)

Resilient infrastructure not only saves lives and livelihoods, but it is the backbone of sustainable development. As countries face larger and more expensive disasters, it is critical that all infrastructure investment decisions be guided by an understanding of current and future disaster risks. The second Global Infrastructure Resilience report (GIR 2025) is a valuable contribution to ensuring that all infrastructure is built to last.

Rachel Kyte

UK Special Representative for Climate, and Professor of Practice in Climate Policy, Blavatnik School of Government, University of Oxford

Infrastructure sits at the intersection of climate ambition, economic stability, and our overall well-being. It determines whether communities can withstand disruption, recover with dignity, and continue to thrive amid rising climate and disaster adversities. CDRI's second Global Infrastructure Resilience report (GIR 2025) deepens this understanding by demonstrating how resilience can be built into infrastructure systems, policies, and finance—not as a secondary consideration but as a central pillar of development strategy.

The report advances the global dialogue on how governments and financial institutions can embed resilience within fiscal and investment frameworks. It sets out a layered approach that integrates public finance, concessional resources, private capital, and coherent planning and policy to strengthen systemic preparedness. In doing so, it reinforces the priorities of the COP30 Presidency—to close the adaptation finance gap, foster stronger multilateral cooperation, and ensure that climate finance reaches the most vulnerable communities without adding fiscal strain. Equally, its focus on enhancing the resilience of renewable energy systems is critical to sustaining net-zero transitions and ensuring reliable, equitable access to essential services.

At a time when resilience is emerging as the nucleus of the global adaptation agenda, GIR 2025 report distinguishes itself by turning complex deliberations into clear, actionable insights. It reinforces that resilient infrastructure is not only about withstanding shocks but about enabling progress, equity, and stability in a world committed to sustainable growth.

Meike Van Ginneken

Water Envoy, Government of the Netherlands

Rainfall has changed. Temperatures are rising. We need to adapt now. CDRI's GIR 2025 report provides data, analysis, and solutions. It shows the urgency of proactive prevention, resilient new infrastructure, and asset management. I recommend the GIR 2025 to help prioritize adaptation investments because we need to get the biggest bang for every buck of climate finance.

Maria Netto

Executive Director, Instituto Clima e Sociedade, Brazil

The GIR 2025 report plays a crucial role in advancing the next generation of finance innovation—one that connects rigorous assessment, investment strategy, and policy vision. By providing data-driven insights and a framework for evaluating resilience, it helps governments, investors, and development institutions understand where and how capital can most effectively support adaptive infrastructure.

Financing resilience requires a new generation of innovation—one that integrates rigorous risk assessment, financial instruments, and long-term planning to align investment flows with adaptation needs. By linking data, technology, and governance, we can transform infrastructure from a source of vulnerability into a driver of stability and opportunity. The resilience dividend is not abstract—it is the economic, social, and environmental return that comes from embedding adaptation at the core of development finance.

Stephane Hallegatte

Chief Climate Economist, The World Bank

In just a few years, CDRI has firmly established its position as an essential actor in economic resilience and infrastructure development, helping government, international organizations, and private actors better understand and quantify the value of more resilient infrastructure. They have done it with robust analytics for risk-informed investments, strong collaborations, and innovative initiatives, and this new report is an important and actionable addition to global knowledge on the opportunities from resilient infrastructure.

Eduardo A. Cavallo

Principal Economic Advisor of the Infrastructure and Energy Sector, Inter-American Development Bank

The GIR 2025 report marks a vital shift from risk management to reliability, placing resilience and equity at the heart of global infrastructure strategies. By emphasizing actionable recommendations and innovative financing, this report addresses the sector's most urgent priorities—ensuring that infrastructure systems can withstand shocks, adapt to changing conditions, and continue delivering essential services for all.

GIR 2025 recognizes that resilience is not only about minimizing losses but also about unlocking long-term economic, social, and environmental benefits. Its focus on practical solutions, inclusive approaches, and new financial instruments will help guide policymakers and practitioners as they work to close investment gaps and build a more sustainable future.

This work is an important contribution to the global agenda, helping move us decisively from risk to reliability and inspiring collaboration across regions and sectors.

Alexandra Galperin

Former Unit Head, Disaster Risk Management, ADB

The second edition of the landmark Global Infrastructure Resilience Report demonstrates convincingly that both the failing and delayed recovery of critical infrastructure sets back economies significantly, and that these costs - especially those related to the loss of function and service continuity - are both socially and economically unsustainable. As such, it is required reading for development policymakers, financing institutions, and operators of infrastructure, and provides a holistic framework to avert or reduce losses by investing in smart strategies to absorb, respond to, and recover from disasters.

Foreword

Governments across the world invest heavily in infrastructure. The provision of infrastructure remains one of the most visible and essential indicators of development. Be it roads, energy, telecom, or water supply, countries are keen to augment their infrastructure assets and improve the quality of life for their citizens. As these assets and services are being planned and expanded, resilience has become an indispensable consideration in every stage of infrastructure design, construction, and operation.

This imperative further calls for systematic investments in risk reduction, risk transfer, and risk management. The mounting losses experienced across the infrastructure sector underscore the cost of inaction. Disasters—whether floods, storms, heatwaves, or earthquakes—can wipe out decades of progress. Building resilience in infrastructure systems helps nations reduce these losses, protect their development gains, and strengthen long-term fiscal stability.

The Coalition for Disaster Resilient Infrastructure (CDRI) was established with the mandate to promote the resilience of infrastructure systems globally. It unites governments, international organizations, financial institutions, the private sector, and research entities to foster a shared understanding of risks and advance practical solutions for resilient infrastructure. Through technical cooperation, capacity building, and the generation of evidence and tools, CDRI advocates for infrastructure systems that can withstand, adapt to, and recover from disasters and climate change.

CDRI's *Global Infrastructure Resilience* (GIR 2023) report marked the beginning of this advocacy. It presented the first comprehensive analysis of global infrastructure risk through the Global Infrastructure Risk Model and Resilience Index (GIRI), quantifying how much countries stand to lose—and gain—by investing in resilience. The report introduced the concept of the 'resilience dividend', showing that resilience is not only about avoided losses but also about broader co-benefits, such as improved service continuity, productivity, and social well-being.

The GIR 2025 report builds on this foundation. It moves the global dialogue from simply understanding risks towards actively managing and reducing them through concrete actions. While the GIRI model remains a powerful analytical tool, the next step is to develop clear, practical methodologies for risk assessment at the national and subnational levels.

Risk modelling and assessment are indispensable for identifying vulnerabilities and prioritizing investments. Yet, they must not remain solely analytical exercises. The findings must be followed by cost-effective and implementable solutions, ranging from improved design standards and asset maintenance to resilient reconstruction and risk-informed planning. National databases on infrastructure losses and damages should be strengthened to improve decision-making and enable more precise quantification of risk.

This report broadens the scope of risk assessment by including emerging hazards, such as heatwaves and cold waves, and infrastructure related to irrigation, which are increasingly relevant in a changing climate. However, the focus remains on translating data and analytics into practical guidance for infrastructure agencies and ministries of finance, planning, and disaster management—aiming to help them embed resilience within national frameworks.

Resilience begins with governance. Weak enforcement of codes, outdated standards, and fragmented responsibilities often compound infrastructure risks. Strengthening regulatory compliance and institutional capacity must, therefore, be at the core of national resilience strategies.

The report highlights that countries with effective governance structures, trained professionals, and coordinated institutions recover faster and sustain growth longer after disasters. It also underscores the importance of embedding resilience across the entire infrastructure life cycle—from planning and procurement to maintenance and reconstruction—and fostering a culture of compliance supported by both public and private sectors.

A critical question before governments is how to finance resilient infrastructure. The GIR 2025 report offers a pragmatic way forward through a layered approach to financing. This involves a combination of budgetary allocations for resilience, contingency funds, credit lines, insurance, and access to international risk pools. No single instrument can address all risks—together, these tools can provide comprehensive protection against fiscal shocks. Within the financial world, innovations in insurance and risk financing are transforming how countries manage disaster-related fiscal risks. International risk pooling mechanisms are emerging as effective means to spread risk and enhance insurance coverage for critical assets. These instruments, complemented by sovereign risk financing and public–private partnerships, can provide faster access to recovery funds and ensure that reconstruction is not only rapid but also resilient.

Governments should prioritize the development of national financial protection strategies that allocate resources across the full disaster cycle—mitigation, preparedness, response, and recovery—and strengthen subnational access to resilience financing.

The GIR 2025 report advances the agenda for resilient infrastructure by combining robust risk analytics, governance reforms, and innovative financing. It provides a roadmap for countries to enhance their institutional capacities and align infrastructure development with long-term resilience goals.

Resilience is no longer an optional consideration—it is a strategic and economic imperative. Countries that invest in resilience not only safeguard their citizens and economies but also create the conditions for sustained, inclusive, and climate-resilient growth. This report calls upon policymakers, planners, financial institutions, and private investors to act collectively and systematically to embed resilience in every stage of infrastructure development.

I would like to commend the authors of this report for their exemplary work in distilling insights from a wide range of global and national research and in presenting them in a clear, coherent, and actionable manner. The report admirably integrates all stages of the risk management cycle—from risk identification and reduction to preparedness, response, and recovery—and offers a comprehensive framework for resilience building. It is a significant contribution to global knowledge and will serve as a valuable guide for infrastructure planners, policymakers, and financial institutions alike.

Krishna Vatsa
Member, National Disaster Management Authority (NDMA)
and India Co-chair, Executive Committee, CDRI

Preface

This year, 2025, saw several disastrous events—including Cyclone Remal in South Asia, floods in Bolivia, an earthquake in Myanmar, and Hurricane Melissa in the Caribbean—which devastated communities, damaged infrastructure, and affected lives and livelihoods. As per the United Nations Office for Disaster Risk Reduction's (UNDRR) *Global Assessment Report 2025*, global disaster costs now exceed $2.3 trillion. Two years ago, the Coalition for Disaster Resilient Infrastructure (CDRI) launched the *Global Infrastructure Resilience Report 2023*, estimating that global average annual losses related to buildings and infrastructure due to multiple geophysical and hydrometeorological hazards exceed $700 billion, or approximately 14 percent of the annual global GDP growth. Climate change is expected to intensify these losses. Disasters have an even greater impact in countries where the infrastructure asset base is low, such as Small Island Developing States or regions such as Africa, where much infrastructure remains to be built. In these places, the loss of a crucial bridge or a hospital can debilitate a community if services are disrupted for long durations.

Infrastructure underpins the development aspirations of nations and is essential to meeting Sustainable Development Goals. With significant infrastructure yet to be built across most of the developing world, and efforts ongoing to retrofit existing infrastructure to address newer challenges in the developed world, a focus on resilient infrastructure can yield significant economic and social benefits. CDRI's research shows that damage and disruption to infrastructure from an event such as a cyclone, flood, heatwave, landslide, or earthquake have a multiplier loss effect on the economy—sometimes as much as ten times the cost of damage. Furthermore, communities that bounce back faster after a disastrous

event face reduced economic losses compared with those where devastation lingers for a longer period.

In this context, resilience is an opportunity to integrate a preparedness lens in infrastructure decisions such that damages are reduced, service disruptions minimized, recovery hastened, and communities are able to withstand and recover from disasters. But how do we do this? In its second *Global Infrastructure Resilience Report 2025*, CDRI examines this question through four key dimensions that are important to increase the resilience of infrastructure systems: technology, finance, institutions and governance, and nature-based solutions. Furthermore, the report features close to 75 case studies to help illustrate what communities are already working towards so that others can learn and adapt.

Resilient infrastructure should be everyone's agenda—infrastructure ministries, finance agencies, disaster management authorities, research institutions, multilateral partners, and the private sector. Each brings a unique perspective and, in collaboration with others, can ensure that disasters do not wipe out generations of progress because infrastructure failed to perform when the community needed it the most.

Amit Prothi
Director General, CDRI

Aerial view of India's Longest Sea Bridge
Mumbai Trans Harbour Sea Link
Source: Shutterstock

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Key Messages

Buildings in Kathmandu, Nepal *Source: Floris Boogaard*

Assessing infrastructure risks and measuring the benefits of resilience are key to resilient infrastructure planning.

1. Risk assessments are invaluable tools to prioritize resilient investments, including maintenance, retrofitting, constructing cost-effective and resilient new assets, and rebuilding damaged assets more efficiently after a disaster.

2. Localized infrastructure risk assessments at national and subnational levels are needed to inform resilience investment decisions. National-level risk assessments can help governments obtain an aggregated overview of risks across various infrastructure sectors, thereby informing national policies more effectively. However, translating policies into action requires a more granular analysis.

3. CDRI's Global Infrastructure Risk Model and Resilience Index (GIRI), developed to conduct infrastructure risk assessments, is not only global—it can also be applied at regional, national, and subnational levels, leveraging better data and local knowledge. The standardized financial risk metrics generated by GIRI represent a common language for identifying, understanding, visualizing, and estimating physical risk to infrastructure.

4. Infrastructure agencies, regulators, ministries of planning and finance, and infrastructure asset operators should mainstream the use of risk assessment and cost-benefit analysis tools to make new infrastructure investment decisions. The quantification of direct and indirect resilience benefits is indispensable for allocating limited funds to maintenance and retrofitting; building new, stronger assets; and rapidly and fully reconstructing after disasters.

II

Recovery-readiness and faster reconstruction reduce the economic impacts of disasters.

5. CDRI's economic impact modelling in eight diverse countries shows that the economic costs associated with infrastructure failures due to disasters are, on average, 7.4 times the cost of direct damage to infrastructure assets. When roads and ports fail, products do not reach the market. If electricity and water services are interrupted, businesses and households suffer.

6. Faster and comprehensive reconstruction after disasters significantly reduces economic losses. If a country is able to execute a full reconstruction over 10 years—instead of the usual long, partial reconstruction processes—the average gross domestic product (GDP) impact in 2050 may decline by more than half, from 7.4 percent to 3 percent. Faster reconstruction reduces the economic impacts even further. Financial and institutional readiness for fast reconstruction is key.

III

Businesses that build end-to-end resilience capabilities can better absorb, respond to, and recover from disasters, and have shorter downtime and faster market-share recovery.

7. According to CDRI's global survey of more than 500 businesses, over three-quarters of respondents believe that clearer policies and stronger enforcement of resilient infrastructure are necessary to protect companies from the impacts of disasters. The ability to withstand and recover from disasters depends not only on the businesses' internal continuity planning and response but also on the timely recovery of the infrastructure services they rely on.

8. The vulnerability of businesses is determined not only by the hazards faced by a company's own sites but also by the resilience of suppliers, logistics, and customers. For many industries, value-chain risks—such as disrupted inputs and blocked logistics nodes—may be more important than direct damage to their facilities. According to the survey, 85 percent of large firms do not consider supplier resilience during vendor selection.

9. To build their resilience, businesses need to test their business continuity plans and support them with detailed standard operating procedures, agreements with reliable vendors and suppliers, and insurance packages to protect their assets and revenues. While insurance penetration is high among large businesses, more than 40 percent recognize they do not have sufficient coverage for disasters.

IV

New technologies are radically changing the way infrastructure becomes resilient.

10. New technologies hold immense promise for transforming the resilience of infrastructure systems. They can help improve the data value chain, communication, and the robustness of the infrastructure system.

11. The cost of new technologies is a fraction of the cost of infrastructure service interruptions. However, the benefits of new technologies for resilience can be short-lived if infrastructure agencies and asset operators do not establish strong standards, incentives, and an organizational culture that fosters innovation and learning. Furthermore, the most cost-effective technologies do not necessarily require high-tech solutions at the forefront of innovation.

12. With clear policies, guidance and incentives, the private sector can be an ally in the technological transformation for infrastructure resilience.

13. Technology is evolving rapidly — its integration into resilience efforts should too. New infrastructure should be designed in a manner that can easily accommodate evolving technologies.

V

Resilient infrastructure financing requires a layered approach, with a range of instruments available to absorb, respond to, and recover from the impacts of disasters.

14. Infrastructure failures not only have significant economic impacts but also increase a country's public debt burden and lower its credit ratings.

15. No single instrument can fully cover all disaster-related risks. A combination of financial instruments, including dedicated resilience budget lines, contingent budgets, loans, insurance, and fast access to international grants and soft credit, is needed. Each of these can be used at different times before, during, and after a disaster.

16. Risk transfer through insurance instruments can provide resources faster than emergency appeals to external donors in a post-disaster situation. Ministries of finance and infrastructure agencies can consider a range of insurance products as part of an overall disaster financing strategy. These products include property and asset insurance, public asset insurance, sector-wide insurance, and catastrophic risk products.

17. Systematic investments in maintenance, retrofitting, data systems, and capacity building for infrastructure professionals are indispensable to building infrastructure resilience. These resilience measures are less visible than building new infrastructure or rebuilding after disasters. However, these 'invisible' measures can bring immense benefits. The survey shows that these actions receive inadequate funding across countries of all income levels.

18. Poorer regions within a country and small, low-income countries cannot ignored. Even small investments to strengthen resilience in areas with a high infrastructure deficit will yield enormous social and economic benefits.

VI

Infrastructure resilience requires strong coordination across government agencies, infrastructure asset owners, operators, businesses and communities.

19. CDRI's Global Infrastructure Resilience Survey received responses from over 3,000 professionals across more than 100 countries. A key message from the survey findings is that strengthening policies, standards, codes, and regulations that adequately address resilience and consider future climate risks is the most critical action governments can take.

20. Procurement processes are critical to embedding resilience into infrastructure projects. Beyond applying technical codes and standards, procurement documents, especially at the design and planning stages, should explicitly include resilience.

21. Infrastructure agencies alone cannot fix the resilience challenge. They need the support of ministries of finance and planning, disaster risk management agencies, subnational governments, standard-setting bodies, and the private sector. Resilience is everybody's business.

22. Infrastructure agencies and disaster risk management authorities must work together to develop integrated disaster preparedness plans, organize drills, strengthen and utilize early warning systems for critical infrastructure services, and mobilize resources for faster and complete reconstruction of more resilient infrastructure.

VII

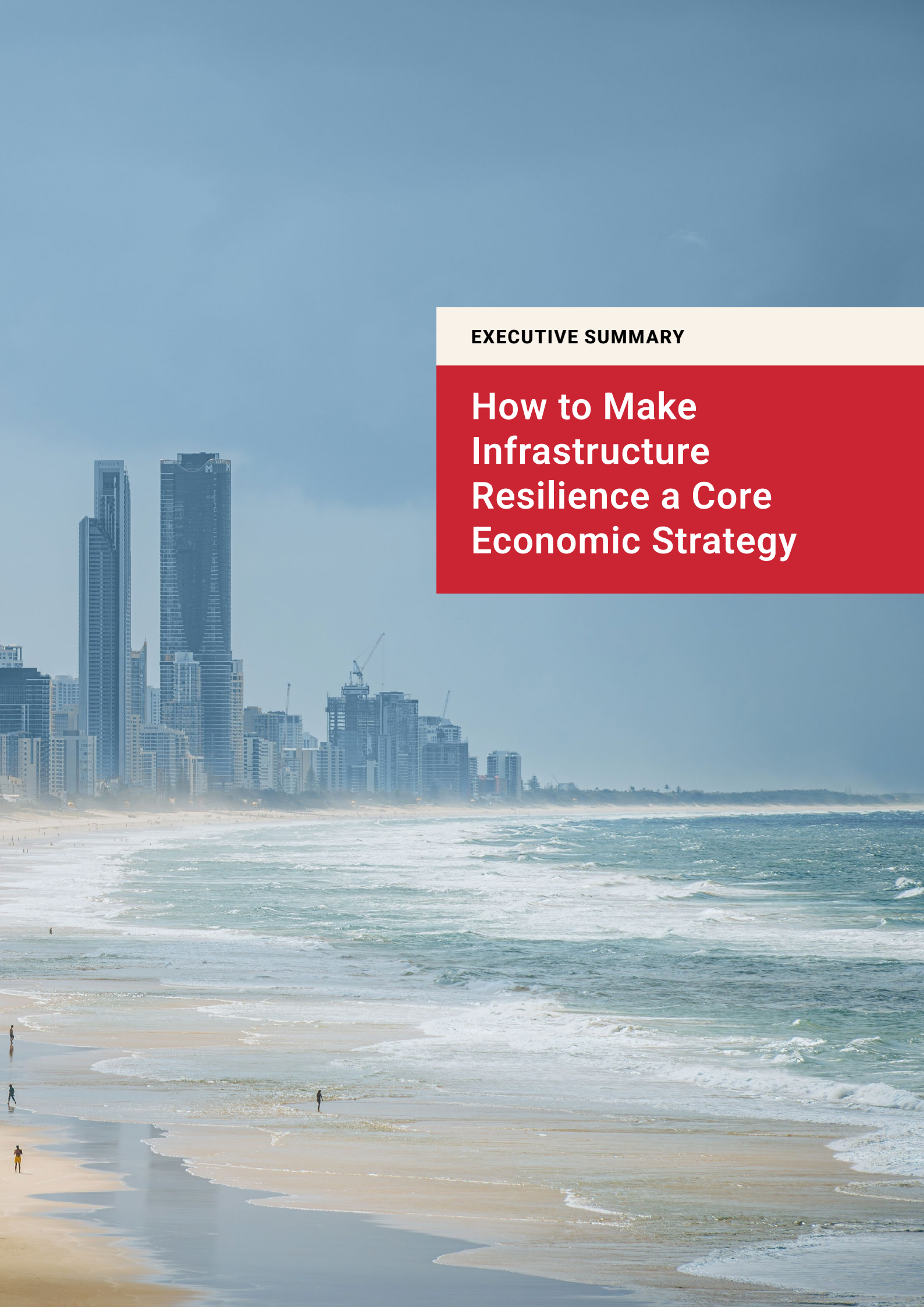
Policies, governance frameworks, standardized technical guidance and well-designed financial instruments are necessary to move NbS from pilots to mainstream infrastructure practice.

23. Nature-based Solutions (NbS) offer cost-effective, adaptive ways to build resilient infrastructure with ecological and social co-benefits. Supported by strong policies and monitoring, NbS can complement traditional infrastructure. They require proactive maintenance and strong engagement across various sectors (water, transport, environment, and disaster risk management), as well as among different actors, including local communities and indigenous groups. Infrastructure agencies will also need to acquire technical expertise in ecology and related fields, in addition to traditional engineering skills.

24. To scale up the implementation of Nature-based Solutions for resilient infrastructure, they should be embedded in master plans, infrastructure strategies, and concession agreements, ensuring that NbS are considered from the outset of infrastructure planning for adaptation, water security, and hazard mitigation, not as optional add-ons.

25. The availability of financial resources and well-designed instruments is indispensable to scaling the use of NbS. Instruments such as blended finance, PPPs, and performance-based contracts align incentives for both public and private actors.

Seafront in Gold Coast, Australia
Source: Getty Images



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How to Make Infrastructure Resilience a Core Economic Strategy

Flooded homes in Fatikchhari, Chittagong, Bangladesh *Source: Shutterstock*

Introduction

GIR 2023 Report: The Infrastructure Resilience Challenge

One of the world's most pressing problems is the growing damage and destruction of roads, ports, dams, power grids, railways, factories, buildings, sewer systems, and countless other forms of critical infrastructure from the increasingly severe impacts of climate change, such as devastating floods and landslides, storm surges, searing heatwaves, and disasters such as earthquakes.

Both the 2030 Agenda for Sustainable Development, endorsed by 193 countries, and the Sendai Framework for Disaster Risk Reduction (SFDRR), 2015–2030, recognize the urgent imperative of making the world's infrastructure more resilient, especially as the number of disasters increases, from an annual average of 371 during 2004–2023 to 393 events in 2024. The latest Global Assessment Report (GAR) estimates that while the inflation-adjusted direct cost of disasters was around $180–$200 billion annually, the annual figure is close to $2.3 trillion when wider social and ecosystem losses are taken into account (UNDRR, 2025).

To address this challenge, the Coalition for Disaster Resilient Infrastructure (CDRI), through its landmark Global Infrastructure Resilience (GIR 2023) report, provided a global estimate and visualization of infrastructure risks and the 'resilience dividend', offering a solid economic and social imperative for investing in infrastructure resilience.

The report introduced the Global Infrastructure Risk Model and Resilience Index (GIRI), the first-ever publicly available tool for estimating infrastructure risks and calculated that damage to global infrastructure from geological and climate-related disasters amounts to more than $700 billion per year. The indirect economic and human toll is far higher than the value of the direct damage from individual geological or weather events. For instance, hurricane winds

not only flatten schools—they can also set back students' education by months or years, with long-term economic and employment consequences. Similarly, floods that damage sewage systems and water treatment plants can lead to the spread of waterborne diseases, sicken or kill thousands of people, and devastate communities.

The GIR 2023 report also highlighted that the financial consequences of infrastructure damage and losses from disasters and weather events are huge. This is especially true in low- and middle-income countries (LMICs), which already face a $3-trillion finance gap in their ability to invest in more resilient infrastructure. In many countries and situations, the lack of resilience can create a vicious economic circle: Rebuilding after disasters depletes national reserves, raises already high debt burdens, increases borrowing costs, and reduces economic output and gross domestic product (GDP). This makes it even more difficult to respond effectively to the next disaster or to invest more in resilience, further worsening the countries' financial situations.

However, if making infrastructure more resilient is one of the most significant challenges of our time, the GIR 2023 report also highlighted a significant opportunity. Bridges, roads, ports, power grids, and every other type of infrastructure that are stronger and more resilient not only will suffer less costly damage when disasters strike than their less resilient counterparts do, but they also bring multiple indirect benefits, such as improved productivity, faster economic growth, poverty reduction, lower national debt, and greater equity. These myriad benefits add up to what is known as the resilience dividend.

The GIR 2023 report estimated that the overall benefits of investments in resilience far outweigh the costs, on average, by at least four times. And for many specific infrastructure assets and sectors, cost–benefit ratios are much higher. When Peru rehabilitated or built dykes to better control flooding in the Casca River Valley, for example, the benefits were 37.5 times higher than the costs.

The GIR 2023 report was a call to action. The world is at a crossroads, it warned. Countries can continue to build back the same after disasters, leading to a worrisome future of declining growth rates, rising risks, increasing liabilities, and greater chances of stranded assets. Or, they can capture the resilience dividend, creating a safer, more resilient, more prosperous world.

Taking Action: The Second Report's Practical Guide to More Resilient Infrastructure

This second report from CDRI, GIR 2025, is an answer to that call to action. It builds on the GIR 2023 report, providing detailed and practical ideas and roadmaps to help countries capture the biggest possible infrastructure resilience dividend.

For the first time, the report defines and analyses in depth three specific and crucial capacities needed to reap the benefits of infrastructure resilience. The first is the capacity of infrastructure and systems to absorb the shock from a disaster. Urban rain gardens and well-maintained drainage systems can absorb or safely carry away water from extreme storms, thereby preventing devastating floods. Buildings, bridges, roads, and ports can be designed and built stronger to withstand the impacts of disasters more effectively, preventing them from entirely collapsing or being damaged and ensuring that goods continue to flow.

Rebuilding damaged bridges in Kedarnath, India *Source: Shutterstock*

The second is the capacity to respond when disaster events occur. Effective early warning systems can alert infrastructure agencies and operators, as well as people and businesses, to prepare or move out of harm's way when disasters loom. Governments can have disaster preparedness plans and mechanisms in place to rapidly repair railway tracks torn up by quakes or storms, or provide safe drinking water and sanitation in flooded cities.

The third is the capacity to recover from disasters. This includes the ability not only to rebuild when assets are damaged or destroyed rapidly, but also to rebuild better and stronger, thereby increasing the capacity to absorb future events.

The threats are growing as climate change intensifies floods, droughts, heatwaves, and other weather events. Increasing these three capacities—to absorb, to respond, and to recover better from disasters—therefore should be at the core of every country's economic strategy.

One of the key messages from this report is that it is critical to reconstruct as rapidly as possible. The macroeconomic modelling exercise undertaken as part of the report shows that annual economic losses from disasters can be as high as 7 percent of a country's GDP when full reconstruction takes 20 years or more. Fully rebuilding in 10 years cuts the annual economic loss in half. Reduce that time to four years or even one year—as Japan has been able to do after some disasters—and the economic and human toll is even lower, preventing the vicious economic cycle that now affects many nations after disasters strike.

Using modelling, surveys, interviews, extensive case studies, and other analyses, the GIR 2025 report charts a path to increasing the three capacities—that is, absorb, respond, and recover—and maximizing the resilience dividend. It identifies significant shortfalls in crucial areas, such as national resilience frameworks, resilience finance, and governance, and shows how those gaps can be addressed. It documents how innovative technologies can help build resilience of infrastructure and how nature-based solutions (NbS) such as living breakwaters in Nigeria or green corridors in Medelin, Colombia, cost-effectively improve resilience, especially when carefully combined with traditional hard or 'grey' infrastructure.

In contrast to many previous reports on adaptation and resilience, where the focus is on the roles of disaster agencies, the core audiences for this report are those who face the threats of worsening disasters directly. For example, the head of airport operations, the technical director at the ministry of roads, city managers, ministers of finance, and the operators of ports, utilities, or urban services.

In addition, this report broadens and deepens the analysis from the GIR 2023 report. Instead of focusing solely on specific infrastructure assets, such as individual bridges, roads, or power lines, it assesses the larger networks, services, and users that depend on those assets. Making networks more resilient can significantly limit the economic impacts of shocks even when specific assets are destroyed. For instance, a power grid that can instantly reroute electricity around downed transmission towers or flooded transformers will be better able to keep lights on and the machines humming at most local businesses, preventing economic disruptions from the loss of services.

The GIR 2025 report's individual chapters cover risk assessments, insights from a global survey with professionals and businesses, the potential contributions of innovative technologies, and ideas for better governance, increased finance, and the application of NbS for infrastructure resilience. Each chapter includes key messages and checklists for governments and stakeholders to assess their own capacities and needs and is supported by additional analyses and examples in corresponding working papers. The report thus offers an actionable roadmap and practical guide for increasing all three key capacities, enabling countries around the world to seize and maximize the infrastructure resilience dividend.

A Deeper Understanding of Risks

Assessing Infrastructure Risks is the Key First Step to Greater Resilience

Only when risks are measured, they can be appropriately managed. This report conducts a second round of rigorous modelling exercises, which include the following:

i. expanding the GIRI model and assessing the impact of heatwaves and cold waves on infrastructure assets;

ii. analysing the impact of disasters and climate change on infrastructure sectors, including irrigation and renewable energy within the power sector;

iii. regional deep dives covering Africa and Small Island Developing States (SIDS);

iv. projecting additional risk that will be accumulated if countries continue to develop new infrastructure with current resilience weaknesses. Additionally, an assessment of the economy-wide implications of infrastructure failures resulting from disasters has also been conducted.

The findings from the modelling exercise show that under different warming scenarios, heatwave-related losses will escalate sharply. In contrast, cold wave losses are expected to decline, indicating a structural shift in the global thermal risk distribution and a change

in the dominant drivers of climate-related infrastructure damage. It also shows that power, transport, and water systems will face the maximum impacts, with the highest estimated annual average losses (AAL) under both heatwave and cold wave scenarios, reflecting strong functional interlinkages and cascading effects across energy demand, mobility, and water service continuity.

The impact on the irrigation sector is expected to be severe across South and Southeast Asia, Central America, and Eastern Africa, especially for countries such as Vietnam, Bangladesh, India, and Thailand, which have a strong agrarian base and rely heavily on irrigation systems.

Understanding the macroeconomic implications of disasters requires integrated modelling approaches that capture not only direct damages to infrastructure but also the systemic, long-term effects of disrupted capital on productivity and production. This report presents the results from simulations created using the green economy model (GEM), which has been parametrised and calibrated to align with GIRI. The GEM was used for eight countries with diverse economic, geographic, and hazard characteristics—Bangladesh, Barbados, Bhutan, Fiji, Ghana, Kenya, Madagascar, and the Philippines—to understand the economy-wide implications of infrastructure failures due to disasters.

The extensive amount of data enabled the analysts to understand the risks to infrastructure in unprecedented detail for the eight countries studied. For example, the highest concentrations of vulnerable buildings in Kenya are found along the coast of the Indian Ocean and in the western regions of Lake Victoria. It was found that Bangladesh would suffer the greatest economic damage among the eight nations, with estimated average annual losses of 10.6 percent of GDP between 2025 and 2050 (see table, right).

Estimated Annual GDP Loss (2025-2050)

Country	GEM average annual GDP loss: 2025 and 2050 (%)
Bangladesh	10.6
Barbados	8.8
Bhutan	3.9
Fiji	4.0
Ghana	6.5
Kenya	4.4
Madagascar	4.9
Philippines	10.1
Average	6.6

The analysis reinforces the conclusion that the total economic damages from disasters (including losses of social and human capital) are far greater than the direct costs of rebuilding all the homes, bridges, and electricity grids damaged or wrecked by each event.

A key finding from the modelling is that the indirect costs incurred by infrastructure failures due to disasters are more than seven times higher than the costs of the direct damage to the infrastructure itself. These indirect economic costs include everything from interruptions in trade to lost jobs and livelihood opportunities. Indeed, the economic losses due to disruptions of services such as electricity or water are much higher than the direct damage to assets.

Heavy rains flood a gas station in New Jersey, USA *Source: Getty Images*

The magnitude of indirect costs can vary widely among countries depending on the strength of the connection between infrastructure and the economy; countries that depend heavily on tourism and trade suffer higher proportions of indirect costs when infrastructure breaks down. The total indirect costs are even higher than the model indicates, as there are health and educational impacts that are amplified by failures in infrastructure services due to disasters. For example, Hurricane Maria devastated Puerto Rico in 2017, destroying almost the entire electricity grid and damaging more than half of all local businesses. Power was still not fully restored 18 months later, causing long-term economic damage. Between 8,000 and 10,000 small businesses were forced to close permanently. Similarly, a deadly 2011 flood in Thailand disrupted the lives of more than 13 million people; impaired supply chains for products such as automobiles and electronics; reduced total household expenditures by up to 14 percent. The total damage and losses from the flood corresponded to 1.1 percent of the country's GDP. In both cases, the indirect costs were far higher than the direct impacts on infrastructure.

It is therefore crucial to consider these significant indirect costs when making decisions about investments in resilience. The modelling results emphasize the importance of increasing the capacity of infrastructure to absorb the shocks from disasters by proactively strengthening roads, ports, schools, or other assets; by building them back better and stronger after damaging events; and by designing new infrastructure to be more resilient. Such steps will deliver multiple benefits, including stimulating economic growth, creating jobs, cutting losses, and reducing the need for reconstruction from future events.

Economic Damages can be Dramatically Reduced through Increased Resilience and Faster Recoveries and Reconstruction

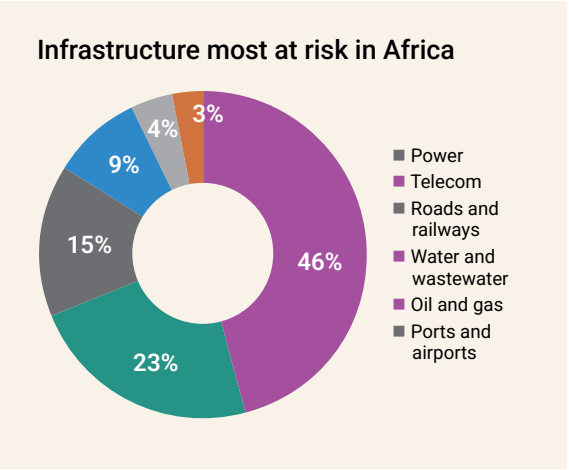
In addition to highlighting the critical importance of building back better, the macroeconomic analysis demonstrates that countries can mitigate the economic impacts of disasters by recovering and reconstructing their economies fully and promptly. The

modelling indicates that the average GDP impact in 2050 across the eight countries studied would decline from 7.4 percent of the GDP with slow and partial reconstruction to 3 percent with full reconstruction over 10 years, and down to just 2.3 percent if reconstruction is completed in four years.

Opportunities for African Nations

For this report, CDRI conducted a first-ever comprehensive review of the risks to infrastructure in Africa. The analysis estimated that the current average losses from disasters are $12.7 billion per year, with 70 percent of those losses being caused by floods and most of the rest due to earthquakes. For some countries, such as Lesotho and Mauritius, the annual economic damages add up to more than 1 percent of their GDP.

The analysis also assessed what types of infrastructure are most at risk. Topping the list is power generation, followed by telecommunications and then roads and railways (see figure, right).



African countries face numerous barriers to reducing these vulnerabilities. They have limited resources for increasing the resilience of existing roads, ports, water supplies, and other key assets, or for setting aside reserves to build back after disasters.

However, they also have three potential advantages. Much of the infrastructure needed to expand access to services such as electricity, water, and sanitation, and to accommodate growing cities and populations, is yet to be built. It is far more cost-effective to construct new assets with additional resilience built in than it is to retrofit existing ones.

Second, Africa has abundant natural resources that could be leveraged to provide NbS that protect existing and future infrastructure. For example, protection for forests and wetlands upstream of cities can both help tame floods and ensure more sustainable water supplies.

Third, African leaders fully understand the threats from climate change impacts and other disasters. They have demonstrated their political will to act with policies such as the African Union Climate Change and Resilient Development Strategy and Action Plan (2022–2032).

Small Island Developing States Face Unique Challenges

The Small Island Developing States (SIDS) are particularly vulnerable to threats such as tropical cyclones, storm surges, sea level rise, and droughts. Many of these nations depend on a single port or airport and a coastal road that encircles each island, decreasing their capacity to absorb shocks. If a storm impairs even one link in that infrastructure, the whole island transport system can fail, with serious economic and social consequences.

Indeed, major storms are taking an enormous toll. In 2017, Hurricane Maria caused $182 million in damages to the transportation infrastructure alone in Dominica. It destroyed or

damaged 95 percent of the island's homes, with total estimated damages of nearly $1.5 billion—or 225 percent of the nation's annual GDP.

The analysis in this report shows that while AALs for the SIDS are lower in absolute terms compared to larger countries, the countries' relative risks are disproportionately high. Even small amounts of damage to infrastructure can exceed the capacity of their economies to recover from disasters.

The report proposes several practical steps to close the resilience gap and boost the nations' capacities to absorb, recover from, and reconstruct after devastating events. They include covering all islands and communities with advanced early warning systems, developing SIDS-specific building codes, and training engineers, contractors, and government leaders to use resilient designs and technologies. CDRI is supporting specific projects to implement these recommendations (see box, below).

Construction and installation of new water pipes in Havana, Cuba *Source: iStock*

Building Resilience Capabilities in SIDS

At COP26, CDRI launched a flagship programme to build capacity and offer financial and technical aid to all 57 SIDS. Called the Infrastructure for Resilient Island States (IRIS), the programme supports 24 projects in 25 countries. Some work towards increasing the capacity to absorb shocks, such as revising Haiti's national building code to strengthen roofs and developing drainage and irrigation systems in **Guyana** to reduce vulnerability to floods. Others focus on improving responses to and recoveries after disasters, including building an early warning system in the **Dominican Republic** and improving the resilience of subsea telecom connections for **Tonga** and **Palau**.

Why Infrastructure Resilience is Currently Insufficient

Insights from Infrastructure Experts, Professionals and other relevant Stakeholders around the World

A Global Infrastructure Resilience Survey of more than 3,000 professionals in over 100 countries, combined with 75 interviews with experts, reveals a worrying picture of countries lagging far behind in the increasingly urgent race to strengthen infrastructure systems in the face of the accelerating impacts of disasters and climate change.

Only 15 percent of the respondents believe that governments have the institutional capacities needed to meet the resilience challenge. Even when national policies and frameworks are more advanced, as in many high- and upper-middle-income countries, implementing those policies at the local level is being crippled by shortages of skilled staff, limited financial resources, and fragmented responsibilities. And while the private sector is seen as having greater capacities and expertise than government agencies do, only about one-third of the respondents think that those private sector capacities and resources are adequate. Moreover, expertise is typically concentrated in large firms and international consultancies, creating systemic resilience gaps. As one expert describes, relying on a few isolated pockets of excellence cannot deliver resilience at the scale that is required.

It is not surprising, then, that only 26 percent of the respondents say that hazard and risk assessments are performed consistently. Only 12 percent report the consistent use of advanced technologies, such as sensors and satellite imagery, for real-time disaster warnings and damage assessments. Only 15 percent say that proven NbS are consistently mandated or applied.

The experts also believe that available resources are too focused simply on building back the same structures after the floodwaters recede or the hurricane passes, and that far more effort is being put into responding to and recovering from disasters than in working to reduce risks before floods or other disasters strike. In addition, there is systematic underinvestment in so-called 'invisible' resilience measures, such as better maintenance, retrofitting, data systems, and capacity building, which can be some of the most cost-effective approaches.

The survey and interviews confirm what other research has suggested: that infrastructure resilience is constrained not by the availability of technical solutions, but by shortfalls in governance and institutional capacities. In particular, half of the respondents say that standards, regulations, and policies must be at the core of resilience strategies, yet only 22 percent say that current policies and standards are adequate even for the risks that the world faces today, let alone the increasing future risks on a warming planet.

Businesses Face Enormous Losses, but Leaders Warn that Resilience Investments and Capacities Fall Far Short of What is Needed

As countries experience increasingly severe impacts of climate change, along with geological events, so do businesses around the world. Disasters cause cascading impacts that often extend far beyond the direct damage to factories, stores, power grids, pipelines, and other infrastructure. Floods that damage manufacturers' machinery can also halt operations for weeks; for example, the lost production slashes profits and puts people out of work. Supply chains can be cut, affecting every downstream business and retail outlet that depends on the goods being shipped.

Winter Storm Uri covered the Tesla Giga Texas facility outside in Austin *Source: Shutterstock*

In 2021, Winter Storm Uri caused major power outages and water supply disruptions across Texas, United States, forcing Samsung's semiconductor plant in Austin to shut down for a month. Not only were thousands of silicon wafers ruined, resulting in an estimated $270–$360 million loss for Samsung, but the lost production also contributed to an existing global chip shortage, affecting the production and delivery of products such as smartphones and automobiles. Following an earthquake in Japan in March 2011, 656 small- to medium-sized enterprises (SMEs) went bankrupt within a year, resulting in the loss of more than 10,000 jobs.

Already, disasters are reducing annual profits for businesses by an estimated 15 percent. If global temperatures rise to 3°C above pre-industrial levels, corporate profits are projected to fall by 25 percent by 2050.

These threats underscore the urgent need for businesses to invest in the capacity to absorb shocks and recover and reconstruct quickly. The good news is that these investments can be enormously cost-effective, with benefits shown to be up to 35 times the costs.

To understand whether businesses currently perceive the threats and the opportunities, and to assess their current levels of preparedness, CDRI conducted the first-ever global survey focusing on the impacts of infrastructure failures and service disruptions on businesses. More than 500 high-level executives (including CEOs and chief sustainability officers) answered questions about how disasters affect their operations, how their companies are responding, and what help they need from the governments. The survey targeted three groups of businesses: private infrastructure companies and state-owned enterprises, such as utilities, railways, and ports; large companies, such as manufacturers, agribusinesses, real estate, and logistics; and SMEs, including suppliers and service providers. It focused on six sectors: food; chemicals and pharmaceuticals; consumer goods; heavy industry; logistics and transportation; and real estate. The responses from the survey were also bolstered by interviews, focus groups, and case studies.

The results reinforce the massive benefits of investing in resilience. In one particularly striking example, Toyota responded to severe disruptions in its supply chains and a major dip in profits after a 2011 earthquake by diversifying its suppliers, building strategic inventories, and implementing new risk management protocols. When floods hit western Japan in 2018, causing $10 billion in business losses overall and forcing other car manufacturers to reduce production for two months, Toyota was able to restore its operations within three days and suffered no material losses.

However, the survey shows that such successes are still rare and that current investments are falling far short of what is needed. In the large business group, 82 percent of the respondents have continuity plans for disasters, but only 39 percent of those plans have been tested. Similarly, 78 percent have disaster risk management policies, but 40 percent lack detailed operating procedures. Around 60 percent still rely on ad-hoc responses, with 52 percent reporting that they lack a dedicated crisis response team. Further, 77 percent say that government policies designed to improve resilience are either entirely absent or poorly enforced. The survey shows that the key challenges in restoring critical operations after disasters include delays in external support, poor internal coordination, and shortages of skilled personnel.

Infrastructure companies face similar challenges as large businesses, though they are more likely to have disaster risk management policies and use technologies that enhance resilience, such as risk analysis and early warning systems.

The SMEs are the least able to cope with disasters, the survey shows. Only 35 percent report that they have detailed continuity plans, and 54 percent say that they lack access to affordable finance, real-time climate information, and insurance products. With limited financial capacity, most SMEs treat resilience spending as discretionary, leaving them vulnerable to even moderate shocks and forcing them to spend their limited resources trying to rebuild and recover from disasters rather than trying to prevent damage from occurring.

The results highlight the critical importance of embedding adaptation and resilience at every stage in the business lifecycle—from strategy and planning to operations and end-of-life—rather than simply making isolated interventions. The report recommends actions in five critical areas: (i) implementing supportive policies, such as tax incentives and subsidies for resilience, post-disaster support, and resilience requirements; (ii) adopting technologies, such as early warning systems, remote sensing, and supply chain mapping; (iii) increasing finance through insurance, budgeting, liquidity tools, and others; (iv) improving governance, such as through better standards, crisis response protocols; and (v) building capacity through training, education, and regular emergency drills.

Technologies for Resilient Infrastructure

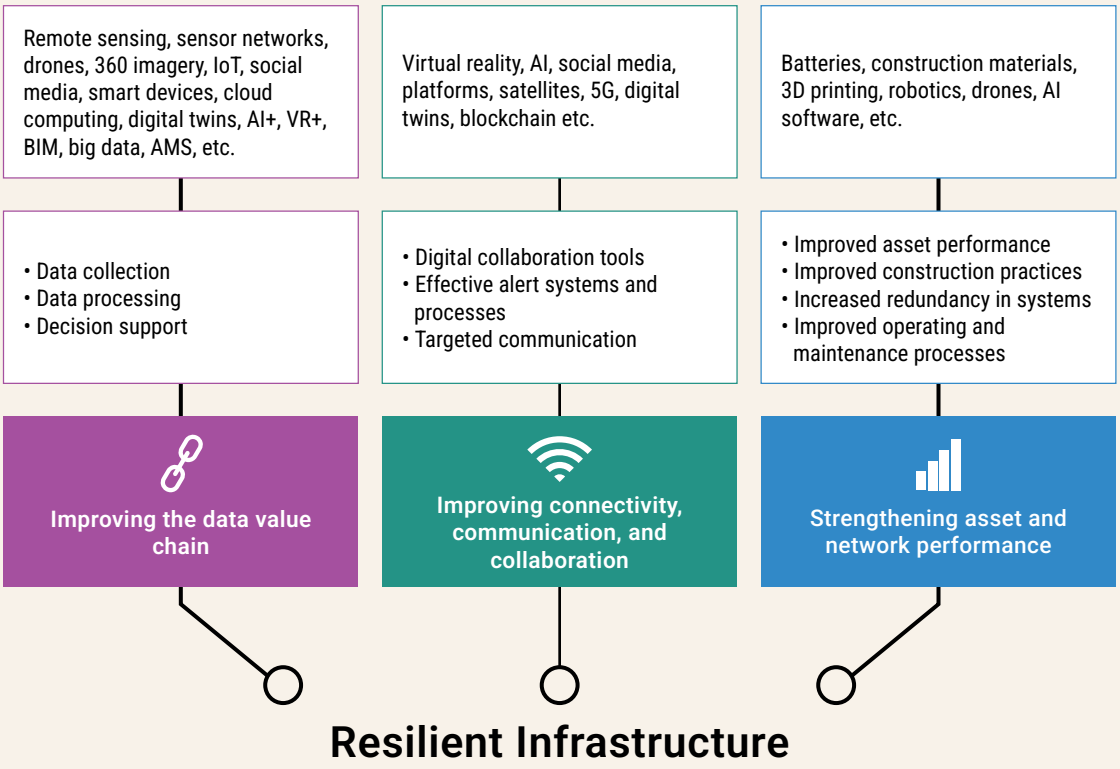
Advanced Technologies Pay Back Their Costs Many Times Over

Even as threats to infrastructure grow due to the increasing severity of climate change impacts, existing and new technologies offer transformative opportunities to make the world's built assets more resilient, helping to absorb shocks better and respond and recover more quickly and effectively.

CDRI reviewed more than 35 types of technologies and several case studies from around the world demonstrating their use. The review shows that these technologies typically pay for themselves many times over by reducing the costs of building and maintaining infrastructure assets; helping to increase the capacity to absorb shocks and thus avoid billions of dollars in losses; and enabling faster recovery and reconstruction after events occur.

These technologies fall into three main functional categories (see figure, below). The first is improving the collection, processing, and use of information. Remote or embedded sensors can report in real time when river levels climb past a dangerous threshold or when power lines or bridges begin to fail, providing crucial early warnings and enabling authorities and operators to take actions to save lives and to better absorb the impacts of shocks.

Drones can be dispatched to assess damage to buildings or measure the spread of floodwater, as well as to monitor everything from roads to crops (see box, next page).



Drones help fight wildfires *Source: Shutterstock*

Drones Improve Capacities to Absorb and Recover from Shocks

In the **United Kingdom**, drones regularly fly above the country's railway tracks, spotting tiny cracks or shifts in the rails that human inspectors might miss. In addition, the Humber Bridge in Yorkshire is the first suspension bridge in the world to be inspected for corrosion, cracks, and cable wear by a fleet of drones using high-resolution cameras and LiDAR sensors—at a cost savings of £1 million over human inspectors. In both cases, the information enables operators to fix weak spots in the infrastructure before disasters occur, limiting damage from the shocks.

Drones have also been used to accurately map damage to buildings and roads after the 2016 earthquake in Muisne, **Ecuador**; to monitor and fight wildfires in the **United States**; and to create a precise 3D model of the Notre Dame Cathedral after the devastating fire. Such data then enables faster and better response and reconstruction.

Sophisticated virtual representations of physical systems, called digital twins, enable real-time monitoring and control of vital assets. In California, for example, the Yuba Water Agency uses drones, sensors, and a digital twin of its New Bullards Bar Dam to regularly monitor the system's health and performance and to respond more quickly and effectively to threatening weather events. Similarly, Lisbon, Portugal, used a digital twin to design a drainage system that will significantly reduce flood risks in the city.

The second group contains technologies that improve connectivity and communication. Satellite internet services can instantly send data and other key information to and from systems or communities in remote areas, while GPS allows locations to be precisely mapped. Mobile apps and social media can alert people, businesses, and emergency personnel to looming events, helping to guarantee that early warning systems reach everyone at risk.

Tools such as blockchain can assure security and privacy in communications, as Vanuatu has done in giving each household a secure digital identity, with all transactions recorded on a tamper-proof ledger. This enables faster and more accurate delivery of relief funds, thus speeding up recovery and reconstruction. Similarly, AI-powered systems can tailor warnings to individual households based on location, type of dwelling, and level of risk, as was done in India when Cyclone Yaas loomed in 2021.

The third category includes technologies that strengthen or improve the performance and resilience of infrastructure or enable more rapid reconstruction. Among the many examples are: solar microgrids or other distributed energy systems that withstand hurricanes better than vulnerable long-distance transmission lines; high-performance concrete that is less susceptive to buckling under stresses; 3D-printed or modular homes that can be built rapidly at a fraction of typical construction costs in case communities are destroyed; and portable water treatment plants that can be rushed to a flooded community to reduce the threat of water-borne diseases.

Taken together, these technologies enable governments to make better, more informed decisions about which assets to rebuild. They also embed greater resilience into both reconstruction after disasters and the design of new systems, reducing future vulnerabilities. By lowering infrastructure life cycle costs and improving monitoring, tracking, and financial accountability, they allow recovery funds to stretch further and have greater impacts.

To accelerate the deployment of these technologies wisely and equitably, CDRI is now developing a data and technology strategy that will identify the key players and the pathways towards a strong enabling environment. The GIR 2025 report also provides a technology readiness checklist that uses targeted questions to diagnose strengths and weaknesses; identify areas where technologies and actions would have the greatest impacts; create comprehensive roadmaps for achievable and sustainable actions; and track progress and capture lessons learned.

Financing Resilient Infrastructure

Boosting Finance for Resilience—and Using it More Cost-Effectively

Implementing the strategies and recommendations outlined in this report requires access to the necessary resources to support the efforts. However, the surveys, interviews, and macroeconomic modelling all point to the same conclusion: the resilience financing gap is a serious problem. The Organisation for Economic Co-operation and Development (OECD), the World Bank, and the United Nations Environment Programme estimate that the total investment needed to improve infrastructure resilience will be $6.9 trillion per year by 2030. For LMICs alone, that adds up to a gap of $3 trillion per year.

Moreover, most current spending is simply reactive, kicking in only after floods, earthquakes, and other disasters cause widespread damage rather than being used to reduce risks before shocks occur. Even this type of financing is seriously inadequate. The Swiss Re Institute estimates that the so-called protection gap (the disparity between insured losses and actual damage) was $1.8 trillion in 2022. One example is the aftermath of a devastating earthquake in Indonesia (see box, next page).

The shortfall in financing for simply replacing what has been damaged has serious long-lasting consequences, especially for LMICs. It lowers their GDPs, depletes often-limited reserves, harms credit ratings, and raises their public debt and borrowing costs.

Damage from the Mamuju earthquake *Source: Shutterstock*

Financing Instruments Often Fall Short

Facing an average of 289 natural disasters per year, with annual direct costs of $1.4 billion, **Indonesia** created a National Disaster Risk Financing and Insurance Strategy in 2018, which uses government budgets, risk pooling, contingency loans, insurance, and other tools to pay for rebuilding after disasters occur. The strategy's first test came after the Mamuju earthquake in 2021, which collapsed homes, hotels, and hospitals, damaged the airport, and caused widespread blackouts. The finance strategy paid only $3.95 million—only a fraction of the replacement costs of the damaged infrastructure.

For example, models estimate that a 1-in-100-year flood event in Bangladesh would cause $54 billion in infrastructure damage, mainly to housing, roads, and power generation. This, in turn, would reduce real GDP by 6.0 percent due to permanent damage to capital and productivity losses across sectors and, consequently, increase public debt significantly.

Similarly, research shows that a 1-in-100 flood event in Thailand could cause GDP losses of 3–4.5 percent, triggering a sovereign credit downgrade and raising annual interest payments by $1.9 billion. However, the analysis also highlights the vital importance of investing in resilience before disasters strike. Modelling shows that by bolstering flood defences and the capacity to absorb shocks at a relatively low cost, Thailand could avoid $30 billion in losses in a 1-in-100-year flood event.

These results emphasize the urgent need for a paradigm shift in infrastructure resilience finance. Instead of being reactive and concentrating on building back just what was lost or damaged in disasters, greater investments must be made both in making existing and new infrastructure more resilient before disasters occur and building back better, which also includes sufficient investments in maintenance and operations. As part of this paradigm shift, governments will need to carefully and judiciously balance their resources to ensure sufficient support for all four key resilience-enhancing measures: improved maintenance, retrofits to make existing assets more robust, building stronger new infrastructure, and faster reconstruction and recovery of services after disasters.

Making this shift and striking the right balance will not be easy. Some of the key challenges involve governance improvements. One example is defining and implementing infrastructure resilience standards for all types of disasters, following the model of increasingly stringent earthquake building codes, such as Japan's Building Standard Law of 1950, revised in 1981, that have dramatically reduced devastation from earthquakes. Other crucial changes include mainstreaming the awareness and consideration of disaster resilience into policies and decisions at all levels of government, in the private sector, and in public–private partnerships (PPPs), covering everything from construction standards and insurance requirements to contingency plans and reliability standards.

In particular, ministries of finance and economics, as well as other government institutions, require expertise to quantify, allocate, and monetize the financial benefits of increased infrastructure resilience. In many cases, this would show that investing in resilience is often the most financially sound option. For instance, allocating limited road funds to drainage systems for reducing flood damage could yield a significantly higher economic return than using the money to widen a stretch of highway. Similarly, a rigorous analysis of building standards or utility regulations that boost resilience would confirm that they offer high cost–benefit ratios, helping to overcome potential opposition to their upfront costs.

However, to close the resilience finance gap, it is also critical to make more funds available for all three resilience capacities: absorbing, responding to, and recovering from shocks. Possible financial instruments for increasing the capacity to absorb shocks include sustainable bonds or dedicated funds. For example, Brazil issued its first sovereign sustainable bonds in 2023, raising $2 billion. Those resources have been used to finance a network of rain gardens and parks along waterways to reduce flooding risk in Campinas. Similarly, in Brazil, the National Land Transport Agency (ANTT) added a 2 percent tariff on road tolls to fund a sustainability programme for increasing the resilience of federal highways and railways.

For responding to disasters, financing can come from such instruments as contingency funds, credit lines, or catastrophe deferred drawdown options (Cat-DDOs). A Cat-DDO is a form of contingent credit offered by development banks that provides pre-approved funds, which become available when a country declares a state of emergency. DDOs have been used successfully by the World Bank and the government of Colombia to respond to economic harm from the 2011 La Niña weather event and COVID-19.

For recovery and reconstruction, effective financial strategies include regional risk pools, budget allocations, and dedicated reconstruction funds. For instance, 40 percent of India's National Disaster Response Fund (NDRF) is dedicated to response and relief, while 30 percent is allocated to recovery and reconstruction.

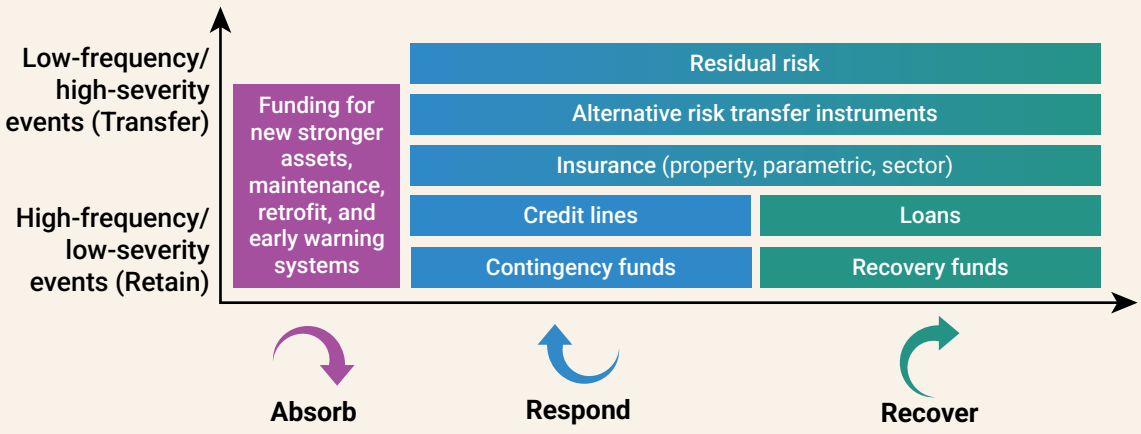
Insurance can also play a major role. Studies show that every percentage point increase in insurance penetration (measured as the ratio of non-life premiums versus GDP) can reduce the recovery times after disasters by nearly 12 months. However, few countries have developed standalone disaster risk financing strategies that rely heavily on insurance, creating a 'protection gap' that makes full recovery and reconstruction difficult.

As the report describes, these financial instruments may be most effective when 'layered', that is, stacking up various strategies depending on the frequency and severity of events. For instance, dedicated maintenance or contingency funds can help enable assets to better absorb or recover from frequent small shocks, while catastrophe bonds can help reconstruct quickly after major events (see figure, below).

To help governments close the infrastructure resilience finance gap and use resources more cost-effectively, this report provides a financial resilience pathway for infrastructure agencies with a series of questions that governments can ask to improve their practices. For example:

- Is the country's level of funding for disaster risk reduction adequate, given the vulnerability of its infrastructure?
- Is the level of residual risk borne by the country's public finances sustainable, given the macroeconomic characteristics of the country?
- Are governments and asset owners able to determine the most effective balance of investments in maintenance, retrofits, building new, more resilient infrastructure, and disaster responses that lead to full and fast reconstruction of assets and recovery of services?
- Do governments have the capacity to identify the weakest links in road networks, airports, and other infrastructure, and the expertise to identify the most cost-effective use of the available finance strategies, including the potential layering of financial instruments?

The answers to these questions will help guide governments as they create detailed action plans for selecting and implementing the best financing options.



Improving Governance

Embedding Core Principles of Resilience into Every Institution

Improving the resilience of infrastructure is fundamentally a governance challenge. Taking advantage of the resilience dividend requires actions to be coordinated across many sectors and at multiple levels.

To identify the critical attributes of effective governance, CDRI reviewed a wide range of existing governance frameworks and looked for insights from 25 case studies (see examples in the box, below). The work identified common barriers to effective governance,

Japan builds back with more earthquake-resilient technology *Source: Getty Images*

Case Studies of Effective Governance

Japan: In addition to the tragic loss of nearly 20,000 lives and the massive destruction of homes and facilities, the Great East Japan Earthquake ripped up railway tracks, destroyed stations and bridges, and flooded trains on the coastal Sanriku Railway, bringing all operations on this vital railway link to a halt. Yet the East Japan Railway Company (JR East) was able to restore some service in five days and 90 percent of service within two weeks, becoming a key symbol of the region's ability to rebound from disaster. One major reason for this was effective pre-disaster governance: Pre-negotiated continuity contracts between JR East and suppliers, along with clearly defined roles for the relevant ministries, allowed work to begin immediately, without bureaucratic delays.

Nepal: Decentralized governance and the use of local knowledge in Nepal's mountain roads programme have enabled the successful use of bamboo crib walls and low-cost drainage systems to protect roads from landslides, erosion, and floods. The use of local engineers, labour, and materials is not only cost-effective, but it also embeds resilience into the social fabric of rural communities, ensuring that the protective measures will be maintained after external funding ends.

such as information gaps, regulatory bottlenecks, and perverse incentives. In Brazil's energy sector, for example, tariff regulations often prevent utilities from classifying resilience measures as recoverable costs, even though such measures would avoid much greater costs of future damage.

Another major barrier is highly siloed governance, with fragmented mandates and overlapping authorities. CDRI's interviews revealed that responses to crises are delayed by the lack of clarity about who is responsible for making decisions.

To overcome these barriers, CDRI identified three key concepts. The first is institutional capacity: having the right institutions, people, systems, and funding in place to ensure that infrastructure is designed to prepare for and withstand disasters and can be quickly repaired if damaged. The second is integrity: making sure that institutional decisions are transparent, legitimate, and accountable. The third is adaptability: the ability to learn from past shortcomings and improve over time. In Brazil, for example, the National Electric Energy Agency (ANEEL) has led a climate vulnerability assessment that will help ensure that plans and tariff regulations are modified to promote resilience instead of being barriers. In Rome, the Aeroporti di Roma (ADR), which operates the Leonardo Da Vinci Airport, has created a 'resilience task force' with partners from civil protection, emergency services, and environmental regulators to analyse and address emerging risks and clarify the roles of each agency and service. That effort has paid off in times of crises, like during the terminal fire in 2015, where swift coordinated action reduced the potential damage and disruption.

CDRI's recommendations for improving governance include embedding core principles of resilience into every institution; integrating resilience throughout the entire life cycles of key assets (from planning to decommissioning); strengthening enforcement; improving coordination among agencies and institutions; and prioritizing long-term maintenance. Everyone in positions of authority must understand the importance of resilience before meaningful improvements can be made—and resilience should be everybody's business.

Harnessing the Power of Nature

Scaling Up Nature-based Solutions (NbS)

The tremendous ability of natural systems to deliver cost-effective resilience is now well established in both theory and practice. Successful examples are found all around the world, many of which demonstrate the large capacity of NbS to absorb shocks.

As the report describes, permeable green spaces in schoolyards in Paris, France, and rain gardens in Portland, Oregon, in the United States, are capturing storm water and slowing runoff, thus reducing flooding threats. Replacing invasive species with olive groves, vineyards, orchards, and pastures under transmission lines in France and Belgium is reducing the risk of crippling storm damage to the lines at one-half to one-quarter the cost of conventional vegetation management, while providing valuable products and creating a more attractive landscape.

A bamboo fence in Indonesia helps protect from water erosion *Source: Getty Images*

In Nepal and Hong Kong, engineering solutions combined with nature-informed design is stabilizing the soil on steep slopes, preventing landslides and erosion that could block or damage roads in mountainous terrains—and providing jobs that boost local economies. Moving flood protection dykes back from the Middle Elbe River in Germany has given the river more room to spread out when rainstorms hit, rejuvenating a degraded landscape and significantly reducing peak water levels for dense urban centres downstream. In Quito, Ecuador, the water utility channels a portion of the tariff to a trust fund dedicated to the implementation and maintenance of upstream NbS for the resilience of its water sources.

In many cases, NbS have been combined with traditional hard or grey infrastructure and implemented at huge scales, such as the Netherlands' Room for the River programme. This successful effort uses a complex system of dykes, groynes, dams, river channels, and other features to protect the nation's infrastructure from floods. Other solutions are as simple as planting trees or leaving rows of corn standing alongside roads in Minnesota, United States, to act as living snow fences, thus reducing accidents and the need for road maintenance, with benefits estimated at 46 times the costs.

This report breaks new ground by showing that NbS can do more than absorb shocks—they also can play a crucial role in building the capacity to maintain critical functions during shocks and to recover more quickly. When hurricanes or other extreme events occur, forests can provide safe evacuation routes or floodwaters can be pumped into wetlands. Similarly, portable green barriers or temporary shading structures can be brought in as an effective response to flooding or heatwaves. NbS should therefore be positioned as being integral to emergency and response operations.

Once the damaging events have passed, NbS also offer pivotal opportunities to build back stronger and safer, while bringing long-term economic benefits. One effective tool is assisted natural regeneration, where native trees and shrubs are carefully nurtured to grow back as quickly as possible. This method can strengthen vulnerable slopes, block mudslides on roads, provide natural buffers, and restore soils and ecosystems. It can also increase yields of crops or forest products, raise incomes and improve local economies, thus strengthening communities' resilience to future shocks.

Overall, NbS typically costs half as much as building grey infrastructure, such as concrete flood walls, while delivering equal or greater benefits. Those benefits include long-term economic gains, environmental improvements, and social benefits, such as improving health through better air quality and providing additional recreational opportunities. Nonetheless, the report emphasizes that the decision is not typically choosing a green or a grey approach but rather identifying the best hybrid grey–green solutions.

The challenge now is moving from the pilot scale to widespread use. CDRI's analysis of successful case studies shows that NbS are not a silver bullet. Each location is different and may require an approach specifically tailored for that location. Scaling up NbS, therefore, will require action at four different strategic levels: (i) increasing awareness and capacity in governments and other institutions, and embedding NbS into master plans; (ii) creating supportive policies; (iii) developing technical expertise at both the government and contractor levels to identify and build optimal designs, calculate ecological and other benefits, and monitor and adapt NbS when needed; and (iv) finding the necessary financial support, in part, by monetizing the co-benefits to strengthen the business case.

To harness this vast natural potential, this report provides a roadmap that governments can use to select, design, implement, and maintain NbS.

Conclusion

Putting these ideas into action is of utmost urgency. Floods, heatwaves, droughts, hurricanes, and other impacts of climate change and geological hazards are becoming more extreme and deadly. Without redoubled efforts now to build all three capacities (absorb, respond, and recover) necessary for improved resilience, countries risk a downward spiral in economic and human capital, characterized by slowing GDP growth, increasing debt, and stumbling poverty reduction efforts.

But countries can choose to avoid this darker future. Instead of simply rebuilding the same as before after floods tear through communities or earthquakes destroy buildings, nations can build back better and stronger. They can proactively plan, design, and build new infrastructure to enhance their resilience. They can harness a wide array of technologies and solutions that will limit or even prevent damage from disasters, while also helping to rebuild faster and better. By putting infrastructure resilience at the core of their economic and development strategies, countries can create a safer, more prosperous, and more equitable world.

EXECUTIVE SUMMARY

Memorandums

Aerial view of the Orwell bridge carrying the A14 road in Ipswich, Suffolk, UK
Source: Getty Images

Estaiada Bridge with the city in Sao Paulo, Brazil *Source: Getty Images*

Memorandum to Finance Ministers

Investments in Resilience will Bring a Sounder Financial Future

In addition to perennial problems like trade tensions and budget deficits, you and other finance ministers are now facing growing damage and destruction to infrastructure from the increasingly severe impacts of climate change and from disasters like earthquakes. The global annual average loss and damage from such disasters is estimated at $732 billion and climbing.

As you well know, rebuilding after such disasters further depletes national reserves, raises already high debt burdens, increases borrowing costs, and reduces economic output and GDP—making it even harder to respond to the next disaster. The second *Global Infrastructure Resilience* (GIR 2025) report from the Coalition for Disaster Resilient Infrastructure (CDRI) documents disasters cause cascading economic costs that dwarf the direct damages to infrastructure. When roads and ports fail, products do not get to the market. When electricity and water services are interrupted, business and household activities can be crippled—often for months. The indirect costs are, on average, more than 7 times the cost of direct damage to infrastructure assets.

That's why we hope you will find this report is both timely and useful. CDRI's Global Infrastructure Risk Model and Resilience Index (GIRI) can provide you with estimated losses for your country and, in many cases, pinpoint the infrastructure and regions that are most at risk.

More importantly, the report offers a roadmap that you can follow to significantly reduce your country's future direct and indirect losses from damage to infrastructure and put the nation's finances on a sounder footing, both in the near- and long-term.

A key first message of this report and many others is that boosting infrastructure resilience brings huge pay offs, with benefit-cost ratios that are four times the investment, and in some cases, twenty-fold. So even as you face the usual pressing and immediate budget challenges, you might consider giving resilience financing a much higher priority, mainstreaming the goal of increasing infrastructure resilience into all financial decisions.

The second key message is that improving resilience is not just a matter of building back better and stronger after disasters strike. It can also be remarkably cost-effective to retrofit existing assets or to maintain them more proactively and effectively. This report offers numerous examples of technologies and other solutions that can improve all types of resilience, from early warning systems to nature-based solutions for absorbing and reducing the impacts of disasters like floods or heatwaves.

The third message is the critical importance of recovering and reconstructing as quickly as possible after disasters. The report's economic modeling shows that that annual economic losses from disasters can be as high as 7 percent of a country's GDP when full reconstruction takes 20 years or more, which is common. Fully rebuilding in 10 years cuts the annual economic damage in half, and the damages drop even more with faster reconstruction.

There will never be sufficient funding to do everything needed for resilient infrastructure. However, risk assessment and cost-benefit analysis tools like those developed by CDRI and partners can help identify the most cost-effective investments. Moreover, GIR 2025 offers a guide to the financial instruments that governments can use to improve each type of resilience.

For example, sustainable bonds or dedicated funds can be used to increase the capacity of existing assets to absorb shocks; for responding to disasters, financing can come from contingency funds, credit lines, or catastrophe deferred drawdown options (Cat-DDOs); for rapid recovery and reconstruction, effective financial strategies include regional risk pools, budget allocations, and dedicated reconstruction funds. These financial instruments may be most effective when 'layered', stacking up different strategies depending on the frequency and severity of events. The report provides a list of questions that can help guide you to the most effective strategies.

The increasing threats to infrastructure assets from disasters are making your job more difficult than it already is. But there is an opportunity for you to put your country on a better, more prosperous path through investments in infrastructure resilience—and we hope that GIR 2025 can help you do that.

Highway bridge construction in Thailand *Source: Getty Images*

Memorandum to Ministers of Infrastructure and Heads of Utilities

Improving the Resilience of the Infrastructure You Oversee Brings Major Benefits

As the leader of your ministry of infrastructure or a key utility, you are now facing growing damage and destruction because of the increasingly severe impacts of climate change and disasters like earthquakes. The global annual average loss and damage from such disasters is estimated at $732 billion and climbing.

The second Global Infrastructure Resilience (GIR 2025) report from the Coalition for Disaster Resilient Infrastructure (CDRI) documents that disasters typically cause cascading economic impacts that dwarf the direct damages to infrastructure. When key infrastructure like roads and ports fail, products do not get to market. When electricity and water services are interrupted, business and household activities can be crippled—often for months. The indirect costs are, on average, more than 7 times the cost of direct damages to infrastructure assets.

It is critical, therefore, that you do everything possible to make your infrastructure better able to withstand the shocks from severe weather events and other disasters, to recover faster in the aftermath of disasters, and to design and build new infrastructure to be more resilient. The good news is that resilience pays. On average the benefits of investments in resilience are four times larger than the costs, and many interventions have much higher benefit-cost ratios.

The GIR 2025 report has been carefully crafted to help you realize the many benefits of improved infrastructure resilience. It is based on robust evidence from CDRI' Global Infrastructure Risk Model and Resilience Index (GIRI) that can help pinpoint infrastructure risks in your country and estimate potential losses from disasters. The report provides deep analysis and numerous case studies to identify practical strategies to improving all three key capabilities of infrastructure resilience; the abilities to better absorb shocks, to respond more effectively when disasters hit, and to recover faster.

Your agency can promote the use risk assessments and cost-benefit analysis to quantify the large direct and indirect benefits of actions that improve resilience and monetize the savings from improved resilience. For instance, new technologies hold immense promise for transforming the resilience of infrastructure systems. They can help improve the data value chain, communication, and the robustness of infrastructure systems. Remote sensors can spot impending disasters before they strike and trigger more effective responses, for example, real-time control systems can instantly reroute power around downed transmission lines or flooded transformers on the electricity grid. Other strategies include harnessing nature's power to mitigate shocks, the way green corridors in Brazil protect communities from floods, while replacing invasive species with olive groves, vineyards and orchards.

Investing in retrofitting programmes and stronger new assets, and seemingly "invisible" measures such as maintenance, capacity building and readiness for rapidly reconstructing after disasters, and technical codes and standards can bring immense benefits.

To fund these resilience actions, GIR 2025 recommends a layered approach that combines dedicated resilience budget lines, contingent budgets and loans, insurance, access to international grants, and other financial instruments. Each of these can be used at different times before, during, and after a disaster, since no single instrument can fully cover all disaster-related risks.

CDRI recognizes that infrastructure agencies cannot meet the resilience challenge alone. You will need the support of the ministries of finance and planning, disaster risk management agencies, subnational governments, the private sector, and many others. But your leadership will be crucial. CDRI hopes that this report will be valuable in helping you to improve the resilience of the crucial infrastructure that you oversee—and to bring major benefits to all those who depend on your work.

Cleanup begins after a landslide in El Chaco, Ecuador *Source: iStock*

Memorandum to Heads of Disaster Risk Management Agencies

DRM Agencies Have Critical and Unique Roles in Increasing Infrastructure Resilience

As the economic and human toll from the impacts of climate change and other disasters increases, your disaster risk management (DRM) agency is uniquely positioned to play a crucial and unique role in enhancing the resilience of all types of infrastructure.

Your central responsibility is coordinating preparedness and emergency response services when disasters occur. To mount an effective response, your emergency teams need critical services like power, water, communications, transportation, healthcare, and shelter. This requires a strong engagement with utilities and infrastructure agencies.

Beyond that, the DRM agency needs to work with infrastructure agencies to ensure they have the capacity to apply risk assessment and cost-benefit analysis tools to design their investment plans and projects to be more resilient. You can also make a valuable contribution by working with ministries of finance to set up and manage the financial instruments needed for effective recovery and reconstruction after disasters. In all these cases, early engagement and clear operational rules agreed in advance with infrastructure agencies are essential for success.

As is generally observed, the capacities of infrastructure agencies at sub-national levels tend to be weaker than those of national agencies. But these regional or local organizations also typically have the best information on the hazards, exposures, and vulnerabilities of specific regions and communities. This information can be extremely helpful in your plans for preparedness and emergency responses –– so strong coordination with them is critical. At the same time, the DRM agency can support these local agencies in developing their own land use and development plans to increase infrastructure resilience.

Finally, DRM agencies have a unique role in monitoring specific indicators of resilience and in ensuring that important data can be shared among hydrometeorological and geological institutions, infrastructure agencies, and local governments.

The Coalition for Disaster Resilient Infrastructure (CDRI) hopes that this second *Global Infrastructure Resilience* (GIR 2025) report will help you perform these critical tasks. It provides deep analyses to identify and estimate risks and damages from disasters, describes innovative technologies that can improve resilience, offers lessons from numerous case studies, and provides detailed roadmaps for actions by governments, business, and other stakeholders. Under your direction, DRM agencies can be critical leaders in the urgent effort to improve the resilience of infrastructure.

Laem Chabang, a key international container port, Thailand *Source*: iStock

Memorandum to CEOs

Improving Infrastructure Resilience is a Critical Economic Imperative for Businesses

The growing impacts of climate change and disasters like earthquakes are increasingly putting the world's critical infrastructure at risk, causing estimated global annual damages to the tune of $732 billion.

For businesses, the harm from disasters can be tremendous and far-reaching. If roads and ports fail, your products may not get to the market and your supply chains may be cut off. If the electricity grid fails, your company may not be able to operate. Your factories and other facilities can suffer direct damage from floods and other events. As a result, in the aftermath of disasters, profitability can plummet—and businesses are often forced to close.

The second *Global Infrastructure Resilience* (GIR 2025) report from the Coalition for Disaster Resilient Infrastructure (CDRI) conducted an economic impact modelling in eight diverse countries. It shows that the economic costs associated with infrastructure failures due to disasters are, on average, more than 7 times the cost of direct damages to infrastructure assets. Increasing resilience is thus a critical economic imperative for businesses, and it is also cost-effective.

For this report, CDRI surveyed more than 500 companies in nearly 60 countries to understand the impacts of infrastructure service failures caused by disasters on business operations and profitability.

Your colleagues told us that most large businesses have prepared for disasters—82 percent have business continuity plans. However, close to 40 percent of them have never tested those plans. Moreover, 40 percent of the companies lack detailed standard operating procedures or execution guidelines for their disaster response plans. Nearly two-thirds of them lack access to reliable providers of resilience solutions.

77 percent of your fellow business leaders say that government policies for resilience are either absent or poorly enforced. And 85 percent of large firms do not consider the resilience of suppliers when they select vendors. If suppliers are affected by a disaster, crucial inputs may not be available.

As GIR 2025 describes, tackling these shortfalls and building resilience in businesses requires more than isolated interventions. It demands a systemic approach that embeds resilience across every stage of the business lifecycle, from strategy and planning to operations. It is also vital to improve the three key capabilities of resilience; the ability to better absorb shocks, to respond more effectively when disasters strike, and to recover faster.

Firms that build these end-to-end resilience capabilities will see important economic gains and competitive advantages, with shorter downtimes and faster market-share recoveries. There are also some major market opportunities, such as expanding insurance products or supplying technologies and services that build resilience.

As you work to build resilience in your own company and supply chains, CDRI hopes that this report can provide valuable guidance. It documents how innovative technologies can pay for themselves many times over through avoided damage and faster recovery. It also offers specific recommendations for businesses, such as building capacity through training and regular emergency drills and working with governments to craft supportive policies. Perhaps most importantly, we hope that the report may inspire you to make infrastructure resilience a top priority for your company.

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GIR 2025
Executive Summary

GIR 2025 Report

This document is a launch edition and may undergo minor changes in design.