Request for Proposal

Hiring an Individual Consultant on New Technologies for Resilient Infrastructure to support the development of the Second Biennial Report on Global Infrastructure Resilience

1. Background

The Coalition for Disaster Resilient Infrastructure (CDRI) is a multi-stakeholder global partnership of national governments, UN agencies and programmes, multilateral development banks and financing mechanisms, the private sector, and academic and knowledge institutions that aims to promote the resilience of new and existing infrastructure systems to climate and disaster risks in support of sustainable development. The vision, mission, goal, and objectives of CDRI are explicitly linked to the post-2015 development agendas. CDRI promotes its Disaster Resilient Infrastructure (DRI) mandate through knowledge exchange and bolstering technical capacities among member countries and partners through the following key Strategic Priorities:

- Advocacy and Partnerships
- Research, Knowledge Management and Capacity Building
- Program Support and Technical Assistance

In line with the Strategic Priorities around Research, Knowledge Management, and Capacity Building, CDRI launched its inaugural Biennial Report, titled "Global Infrastructure Resilience: Capturing the Resilience Dividend" in October 2023. The Biennial Report serves as CDRI's principal vehicle for engaging and focusing the attention of global leaders, policymakers, practitioners, and researchers in addressing the critical and multifaceted challenges posed by disaster and climate resilient infrastructure.

2. The First CDRI Biennial Report

The first edition of the Biennial Report is a significant milestone in CDRI's ongoing effort to advance disaster and climate-resilient infrastructure globally. The Report addresses the unique challenges LMICs face. It outlines pathways for global resilience improvement, leveraging data from the first-ever fully probabilistic global risk assessment of infrastructure assets, known as the Global Infrastructure Risk Model & Resilience Index (GIRI). GIRI assesses the risk and resilience across nine major critical infrastructure assets covering seven hazards at a global level to arrive at financial metrics to prompt countries to formulate policies, plans, and strategies that incorporate resilience. Further, through rigorous data, evidence, and outputs, the Report underscores the idea of the "resilience dividend" that can support countries in transforming the perception of resilience from a cost to an opportunity, fostering financial incentives for resilience investments that benefit governments, investors, and communities alike.

The First Report outlines four critical dimensions for enhancing infrastructure resilience and capturing the resilience dividend, starting with improving infrastructure governance that involves enhanced planning, design standards, codes, regulations, compliance with Operations and
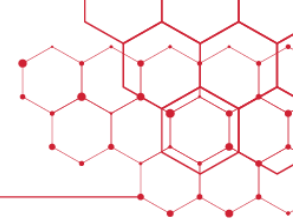
Maintenance, and sharing of best practices to ensure the reliability and quality of infrastructure. The second dimension is investing in resilience by tapping private institutional capital (US$ 106 trillion worldwide) and innovative financial mechanisms. The Report also highlights the need for knowledge sharing and capacity building on infrastructure resilience. Lastly, it explores the innovative use of nature-based infrastructure solutions to integrate natural systems in infrastructure design and operation strategies. The Biennial Report and its Executive Summary are now available for download at cdri.world/gir. The GIRI data platform, that facilitates visualization, interpretation, and analysis of data from the GIRI model, is accessible at cdri.world/giri.

3. The Second Biennial Report

CDRI now plans to publish the second edition of the Biennial Report by October 2025 (hereafter referred to as "the Report"). The Report will build on the comprehensive risk assessment methodology with global applicability developed for the first report. The Report aims to answer some of the questions raised during the preparation and dissemination of the first Report, expanding its remit and strengthening the connections between the risk analysis and the financial, institutional, and technological dimensions of resilient infrastructure.

The Report is organized along two main pillars. The first pillar is based on a series of modeling and analytical pieces that deepen, downscale, and project the results of the first Biennial Report into the future. The second pillar advances the work of the first Biennial Report from the "what is the resilience dividend" to the "how to capture the resilience dividend."

Pillar 1: Deepening, Downscaling, Projecting: The Report expands the work of the first report along three lines of work:

- *__Deepening__* the understanding of resilient infrastructure by (i) incorporating additional risks and updating the model with new databases; (ii) undertaking specific assessments of economic and poverty impacts due to infrastructure services failures caused by disasters; and (iii) completing global surveys to understand better the underlying factors of insufficient resilience and the impacts on businesses and the economy.
- *__Downscaling__* the global analysis undertaken for the first Biennial Report to the country and sub-national level to provide higher-quality risk assessments using better data and understanding of local conditions through national partners. At the same time, these analyses will review options, costs, and benefits of resilience and adaptation measures to reduce the impacts of disasters on infrastructure assets, systems, and services.
- *__Projecting__* the modeling exercise to incorporate future expected trends, including investment trajectories to achieve the infrastructure-related Sustainable Development Goals (SDG) targets, the projected growth of urban centers, and related areas of analysis.

Pillar 2: How to Capture the Resilience Dividend

The first Biennial Report provided a robust analysis of the magnitude of the "resilience dividend" at the global and national levels. The first report also took the first steps in analyzing ways in which
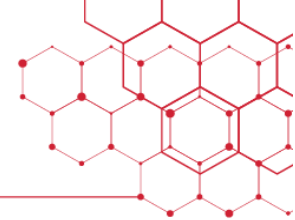
more resilient and climate-adapted infrastructure can be built and maintained, including nature-based solutions and financial mechanisms. The Second Biennial Report will be built on the foundation of the first report. It intends to move from the question of "What is the magnitude of the potential resilience dividend?" to "How can this resilience dividend be captured?" Under this Pillar, the Report will review: (i) financial instruments for resilience and adaptation; (ii) institutional, governance, and capacity frameworks; and (iii) frontier tools, including new technologies and nature-based solutions, among others. Thus, the Biennial Report will be prepared with six workstreams:

- GIRI modeling
- Finance
- Institutions and Governance
- New technologies
- Nature-based solutions
- Surveys

These workstreams will develop their outputs in a coordinated manner, and each will provide a background report and a chapter for the integrated Biennial Report.
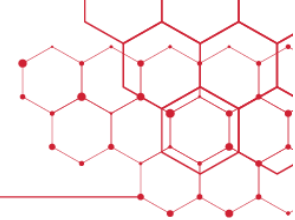
4. Common Analytical Framework Across Biennial Report Chapters

To ensure consistency across the background technical reports and the Biennial Report chapters derived from them, a common analytical framework has been developed, building on the approach used in the first Biennial Report.

The operational disturbance of infrastructure assets due to disasters and the subsequent recovery can be described in three states or phases as shown in Figure 1: a degraded state, a recovery state, and a post-recovery state. The resilience of an infrastructure asset is not only related to its capacity to absorb shocks caused by disasters, but also the capacity of institutions to respond to the disaster and to recover from it. These three capacities: (i) to absorb; (ii) to respond to; and (iii) to recover from a disaster will be core to all chapters in the Biennial Report.
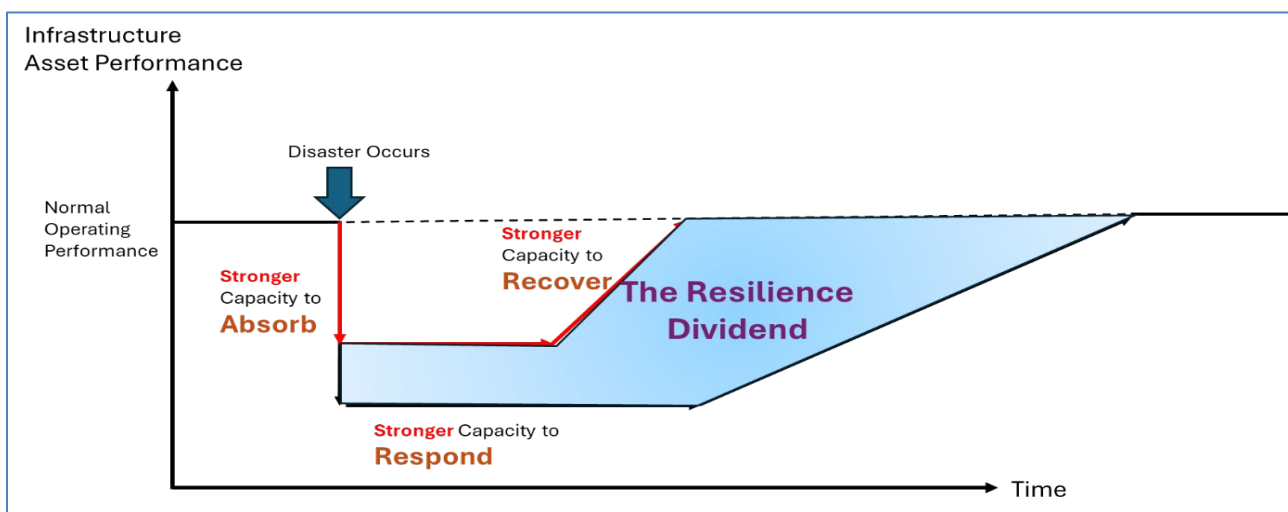
Figure 1 – Three Core Capacities of Infrastructure Resilience
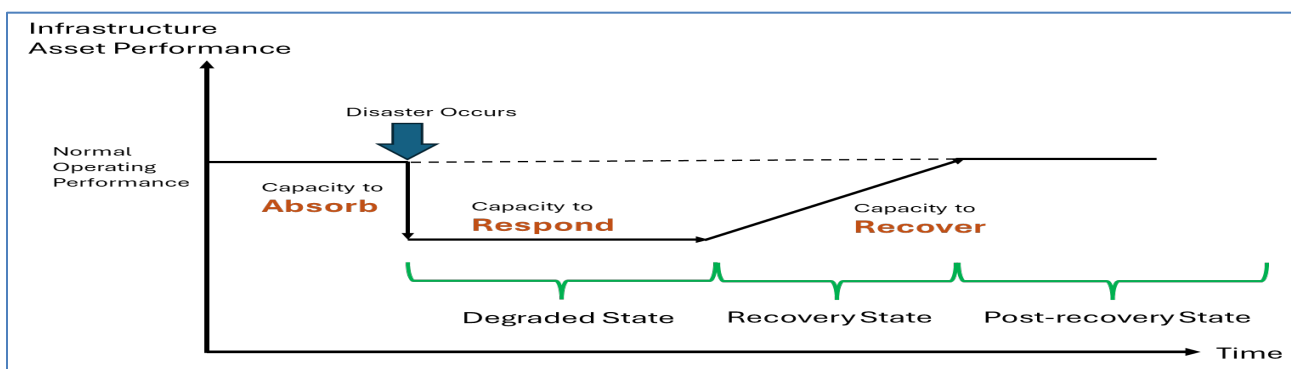
As countries strengthen their capacities to absorb, respond, and recover from disasters, they are able to capture the "resilience dividend," shown in the shaded area of Figure 2.
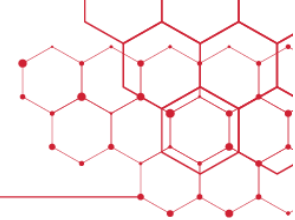
Figure 2 – The Resilience Dividend

The Biennial Report will frame the analysis of the finance, institutional/governance/capacity, technology, and nature-based solutions chapters in ways that directly help strengthen the capacities to absorb, respond to, and recover from disasters.

5. Definition of New Technologies for Resilient Infrastructure

For the purpose of the Report, new technologies are broadly defined as: (i) emerging technologies (beyond proof of concept) that have the potential to scale up globally (and with significant benefits to the resilience of infrastructure; (ii) new ways of using existing and tested technologies for enhanced resilient infrastructure; (iii) new technologies that enhance the enabling environment to make existing and future infrastructure more resilient (climate and weather data, risk analytics, etc.).

Box 1 presents examples of the types of new technologies to be analyzed as part of this consultancy.

It is important to note that this Report is not intended to simply list new technologies for resilient infrastructure, as these are rapidly changing. Rather, the Report is to help readers (government officials, infrastructure specialists, financiers, among others) understand the categories, trends, benefits, and related issues associated with the use and evolution of new technologies for resilient infrastructure.


Box 1 – Examples of New Technologies for Resilient Infrastructure
- **Digital Technologies:** Remote Sensing, Machine Learning (ML), Geographical Information Systems (GIS), drones, Augmented Reality (AR), Virtual Reality (VR), Artificial Intelligence (AI), social media, communication networks, Internet of Things (IoT), Blockchain, Cloud computing for disaster management and resilience, specifically for infrastructure.
- **Data Quality for Predictive Modelling:** Explore how these technologies can improve data quality for predictive modelling of disasters, thereby enhancing early warning systems and the overall capacity to absorb impacts of disasters on infrastructure.
- **Simulation Software Development:** Explore how simulation software(s) can be developed to better understand the upstream and downstream impacts of existing infrastructure, aiding in effective design and planning of new infrastructure and retrofitting of the existing.
- **Sensor Technologies for Maintenance:** Identify notable sensor technologies for the operation and maintenance of infrastructure, providing real-time status updates and insights.
- **Event Simulations for response and recovery:** Analyse how AR and VR and other relevant technologies can support effective disaster response by preparing populations (especially vulnerable groups and communities) and emergency responders.
- **Improving Disaster Detection Accuracy:** Explore ways to enhance the accuracy of disaster detection using these technologies, focusing on refining data collection, processing, and extraction for real-time response.
- **AI in Communication:** Assess the role of recent advances in AI, such as Natural Language Processing (NLP) and chatbots etc., in improving communication between infrastructure agencies and service providers with the public and emergency responders during disaster response and recovery.
- **Technologies for Damage Assessment:** Identify how technologies like ML algorithms, drones, GIS, and remote sensing (amongst others) can be optimally used for loss and damage of infrastructure assets, and post-disaster needs assessments.
- **Leveraging Technology for Relief Operations:** Determine the optimal use of technology for relief operations and restoration of basic infrastructure services, including resource allocation such as cash transfers (using Blockchain) and essential supplies (using drones). These correspond not simply to populations but also infrastructure assets.
- **Social media for Emergency Communication:** Explore how social media platforms (Twitter, Facebook, Instagram) and digital infrastructure systems can be effectively used for emergency communication and outreach, ensuring accuracy and combating misinformation.

6. New Technologies to Enhance the Capacity of Infrastructure Assets to Absorb, Respond to, and Recover from Disasters

The main objective of this consultancy is to present the current state and trends of new technologies (as defined in Section 5) to enhance the capacity of infrastructure assets to absorb, respond, and recover from disasters (as discussed in Section 4).

During the consultation process for the Biennial Report's concept note, the following questions were raised as important to be answered by the Technology workstream when analyzing the capacities to absorb, respond, and recover:
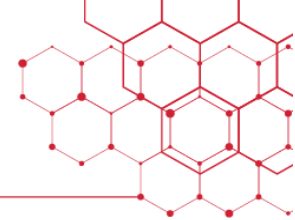
Capacity to Absorb
- What frontier technologies can enhance the capacity of different infrastructure assets to absorb the impacts of disasters?
- What are new developments for monitoring, maintenance, and proactive enhancements of infrastructure to strengthen the capacity to absorb?
- How can new technologies for early warning be used to enhance the capacity of infrastructure assets to absorb the impacts of disasters?
- What technologies and platforms can help users better absorb the compounding or downstream impacts of infrastructure assets affected by disasters?
- How can PPPs be used to encourage the private sector's innovative use of new technologies to enhance the asset's capacity to absorb?

Capacity to Respond and Recover
- What new technologies can accelerate the response and recovery of infrastructure assets?
- How can technologies and platforms help users find alternative means to access the infrastructure service affected by the damaged asset?
- How can technologies and platforms be used to leverage infrastructure networks to reduce the impact on services after the failure of assets in the network?
- What new technologies can help learn relevant lessons to enhance the resilience of the repaired or rebuilt asset?

All workstreams, including the new technologies, will extend their analysis to go beyond the resilience of individual infrastructure assets and consider the network/system of connected infrastructure sectors (electricity, transport, etc.), the services they provide, and the users of these services. For further details, see the World Bank's Lifelines report. Specifically, the analysis will go beyond individual infrastructure assets (bridge, port), and review how new technologies can help infrastructure agencies leverage the network's resilience (road network or electricity network). Going a step further, the technology workstream will look at ways in which new technologies can support users in working around the failure of infrastructure services (e.g., social media platforms and AI tools to help users make informed decisions upon service failures, new technologies for rapid identification of affected users that require specific support after service failures, etc.) Again, the technology work should not simply focus on a list of technologies. Rather, it should help infrastructure agencies, government, operators, and other stakeholders analyze options and make informed choices for new technologies to advance the resilience of infrastructure assets, services, and users.

7. Data for Infrastructure Resilience and New Technologies

An important area of work that deserves a deep dive in the new technology workstream of the Biennial Report is the use of data (including big data, IoT, remote sensing, new technologies for data collection and infrastructure monitoring, etc.)

As part of the analysis on data for resilient infrastructure, the new technology workstream should explore the following questions and issues:
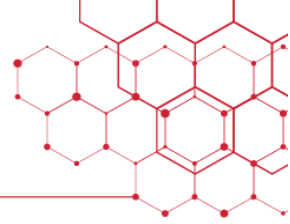
Capacity to Absorb

- How can data be collected, organized, shared, and used to provide the elements to determine what level of absorption capacity to disasters is feasible for (new and retrofitted) infrastructure assets?
- What are new developments in data for monitoring, maintenance, and proactive enhancements of infrastructure to strengthen the capacity to absorb?
- How can data for early warning be used to enhance the capacity of infrastructure assets to absorb the impacts of disasters through enhanced institutional arrangements between agencies that collect that data and infrastructure agencies that use that data?
- What data can be collected, organized, shared, and used to help users better absorb the compounding or downstream impacts of infrastructure assets affected by disasters?

Capacity to Respond and Recover

- What data can be collected, organized, shared, and used to accelerate the response and recovery of infrastructure assets?
- How can data systems and platforms help users find alternative means to access the infrastructure service affected by the damaged asset?
- How can data be collected after disasters to learn relevant lessons to enhance the resilience of the repaired or rebuilt asset?

8. Coordination with Other Workstreams of Biennial Report

The Biennial Report workstreams will develop their activities in close coordination with other workstreams. This will lead to Report chapters that are interlinked and coordinated. Specifically, the technology background report and chapter will need to prepare coordinated analyses on the following two topics that are led by other workstreams:

- Institutions, governance, and capacity: The technology workstream should analyze, in coordination with the institutions, governance, and capacity workstream, the following issues:
  - What should be the readiness and capacity of institutions engaged in infrastructure (from regulators to financiers, implementors, and operators) to understand, absorb, procure, maintain, and update new technologies that enhance infrastructure resilience?
  - What should be capacities and governance arrangements to deliver on the above issues?
  - What should be the institutional and governance relations between the public and private sectors, community groups, and civil society with respect to new technologies that support resilient infrastructure?
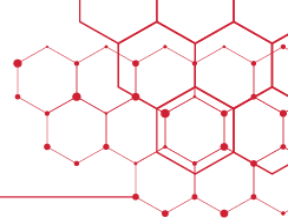
- Finance: The technology workstream should analyze, in coordination with the finance workstream, the following questions:
  - What financial mechanisms and instruments are needed to support the use, development, and upgrading of technologies for enhanced infrastructure resilience?
  - What tools can be used for cost-to-benefit ratios of new technologies for resilient infrastructure?
- Surveys: The technology workstream should provide inputs to the Survey questionnaire to understand ways in which new technologies are used by countries to enhance the resilience of infrastructure assets, services, and users.

9. The "How To" Use and Leverage New Technologies to Capture the "Resilience Dividend"

As with other workstreams, the technology workstream of the Biennial Report should provide the following elements in their report to answer the "how to" leverage technologies to capture the "resilience dividend":

- **Approaches** for governments to continuously scan the horizon, understand, and leverage new technologies.
- **Tools** to: (i) identify the level of utilization of new technologies to enhance the resilience of infrastructure systems; (ii) conduct a gap analysis (including cost-benefit analysis); and (iii) work with the private sector to develop, test, and scale-up use of disruptive technologies to enhance the resilience of infrastructure assets, networks, services, and users.
- **Global examples and good practices** of new technologies to capture the resilience dividend
- **Roadmap** to gradually enhance the use of new technologies to strengthen the resilience of infrastructure assets, networks, services, and users.

10. Objectives of the assignment

CDRI aims to onboard an Individual Consultant for the Technology Track, who, while working under the supervision of the Coordinating Lead Author of the Report, and in close coordination with the Report Project Management Unit (PMU) at CDRI, will be responsible for the technology aspects of the Report.

Specifically, the main objectives of this assignment are:

- To provide technical expertise, advice, authorship, and overarching support on the theme of new technologies for resilient infrastructure for the Report.
- To prepare a detailed background report and a summary chapter catering to "Technologies for Resilient Infrastructure" for the Report, as part of Pillar 2. This chapter will be focused on new technologies to strengthen the capacity of infrastructure assets, systems, and users to absorb, respond, and recover from disasters. The background report and summary chapter need to focus on the "how to" capture the resilient infrastructure dividend from the technological
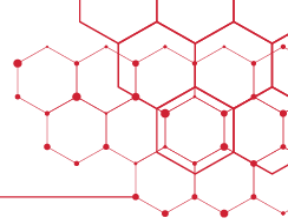
perspective and provide practical "roadmaps" for countries to take steps to capture such dividend. The background report should cover the items listed in Sections 5 to 9 of these Terms of Reference.

- To coordinate with the authors of the Biennial Report (GIRI, institutions, finance, nature-based solutions, and surveys) in a manner that ensures consistent messages on institutions, governance, and capacity of new technologies, and instruments to finance new technologies for resilience.
- The consultant is expected to ensure timely delivery of all services for a smooth launch of the Report in October 2025 and support the dissemination efforts until January 2026.

11. Timeline for delivery

The consultant will deliver on all outlined tasks from the date of commencement of the contract until January 2026.

12. Scope of work

The Individual Consultant on Technologies will have the following responsibilities while working under the guidance of the Coordinating Lead Author on the second edition of the Biennial Report and in close coordination with the Report's PMU:

1. Provide technical expertise in the areas of Technologies for Resilient Infrastructure for all Report activities.
2. Undertake a thorough and exhaustive literature review to bring the latest practices, policies, and innovations in technologies for resilient infrastructure.
3. Author a background report and a summary chapter for the Report focusing on new technologies for resilient infrastructure and in alignment with thematic focus and other chapters of the Report. This will entail the preparation of an annotated outline for review by CDRI.
4. Collaboratively work with the Coalition member countries to identify good practices and country examples on the use of new technologies for enhancing the resilience of infrastructure assets, networks, services, and users.
5. Participate in meetings at designated intervals with the Coordinating Lead Author, PMU, and other consultants engaged on the report (both in person and remotely, with in person meetings expected to take (3 to 4) working days over the period of the assignment (plus travel time).
6. Participate actively in dissemination and outreach activities for the Report.
7. Prepare and deliver on the following:
   a. An inception report
   b. An annotated outline of the background report
   c. Intermediate reports with: (i) the proposed approach to country cases and good practices, (iii) a framework for the roadmap to strengthen the use of new technologies
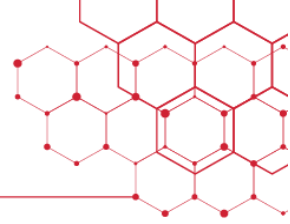
for infrastructure resilience, and (iv) other small inputs as agreed with the Coordinating Lead Author.

d. <u>Draft and final versions of a background report</u> on the "New Technologies for Resilient Infrastructure" track.

e. <u>Draft and final versions of the Summary chapter</u> on "New Technologies for Resilient Infrastructure".

13. Deliverables

1. **Inception Report:** A detailed inception report comprising of the findings from research and analysis on the technology component within the Second Biennial Report. The inception report should also incorporate the approach, workplan and timelines for drafting the background report and the summary chapter draft.

2. **An annotated outline of the background report:** After the preparation of the inception report, based on the feedback and suggestions by the CDRI core team –prepare the outline of the background report and the summary chapter including the references, literature and databases that would be feeding into the narrative.

3. **Preparation of the intermediate reports:** Draft intermediate reports with: (i) the proposed approach to country cases and good practices, (iii) a framework for the roadmap to strengthen the use of new technologies for infrastructure resilience, and (iv) other small inputs as agreed with the Coordinating Lead Author.

4. **Preparation of the background report:** The background report will be prepared, serving as the reference point for the summary chapter.

5. **Summary Chapter on "Technologies for Resilient Infrastructure" for the Second Biennial Report:** A complete chapter on "Technologies for DRI" for the Second Biennial Report is to be drafted and submitted, providing actionable insights and recommendations.

14. Duration

The consultancy is expected to last until January 2026, with specific milestones and deadlines to be agreed upon at the outset of the engagement to ensure the timely launch of the Report.

15. Reporting

The Consultant will work in close coordination with the Coordinating Lead Author for the Report and report to the Director (RKM&CD) and Lead Specialist – Biennial Report providing regular updates on progress, challenges, and key decisions.
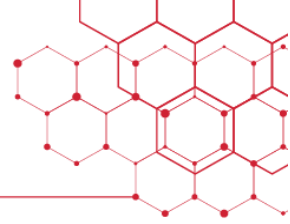
16. Qualifications

- A minimum of 15 years of experience in sectors associated with technology, engineering, disaster management, disaster resilience, environment, resilient infrastructure, and related fields.

- A minimum of a master's degree in these disciplines; a PhD is preferred.

- Proven experience in the use of new technologies for resilient infrastructure.

- Proven experience in developing global reports and strategic, technical documents related to disaster resilience, technology, infrastructure resilience, sustainable infrastructure, and related fields.

- Excellent writing and communication skills in English.

- A proven track record of working with international organizations or in multicultural settings.

17. Submission

Please share proposals in two separate PDF files:

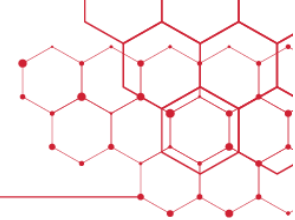a) **Technical Proposal (Open PDF file)** catering to the following:

1. **Curriculum Vitae:** Outlining relevant academic and professional experience and expertise that demonstrates alignment to the key objectives, scope of work, key competencies and the overarching thematic focus of Financing for Resilient Infrastructure.

2. **Technical Approach & Workplan:** A detailed description of the proposed approach and workplan for the outlined deliverables, based on the respective key objectives and scope of work.

3. **Timeline:** An estimated timeline for outlined deliverables, based on the respective key objectives and scope of work.

b) **Financial Proposal (Password-Protected PDF File)**: A detailed cost estimate for the proposed work based on consultancy rates per day and the number of man-days to be entailed for this work. This proposal must cover all aspects mentioned in the scope of work. All payments shall be subject to tax deduction at source per the tax laws of India.

Note: The Financial Proposal PDF should be password protected. The password for FINANCIAL PROPOSAL MUST NOT BE SHARED ALONG WITH PROPOSAL. The password for the financial proposal will be requested separately.

18. Evaluation

i. The consultant will be selected following a Quality Cum Cost Basis (QCBS) of selection.
ii. Proposals shall be evaluated as follows: Evaluation Criteria for Technical Bids 100 points:

S.N.	Technical Evaluation Criteria	Maximum Marks
1	Academic qualification	10
2	Professional work experience (including specific assignments related to the use of new technologies in resilient infrastructure)	40
3	Experience in working on reports/strategic documents on a global scale	10
4	Technical approach and workplan for the assignment	30
5	Experience of working with International Organization(s) or in a multicultural setting	10

Rating Multiplier	
Level of Responsiveness	**Rating**
Non-Responsive	0%
Poor	25%
Satisfactory	50%
Good	75%
Very Good	90%
Excellent	100%

iii. The consultant scoring more than 70% in the technical evaluation shall be considered for financial evaluation. 80% weightage will be awarded for the Technical Proposal and 20% weightage will be awarded for the Financial Proposal. Technical Bid will be assigned a Technical score (Ts) out of a maximum of 100 points.

iv. The consultant's Financial Scores (Fn) are normalized as per the formula below:

Fn = Fmin/Fb * 100 (rounded off to 4 decimal places) Where,
Fn = Normalized commercial score for the consultant under consideration
Fb = Absolute financial quote for the consultant under consideration
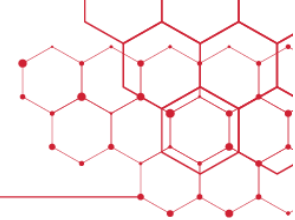Fmin = Minimum absolute financial quote

The formula for final evaluation:

Composite Score (S) = Ts * 0.80 + Fn * 0.20

The consultant with the highest Composite Score (S) will be considered for the award of the contract and will be called for negotiations if required.

19. Terms of payment

This would be a lump-sum contract with the following payment schedule. Payments will be made upon approval of the submissions/deliverables by competent authorities at CDRI.

S. N.	Deliverables across 12 months beginning from the date of onboarding	Payment
1	**Inception Report:** A detailed inception report comprising of the findings from research and analysis on the technology component within the Second Biennial Report. The inception report should also incorporate the approach, workplan and timelines for drafting the background report and the final chapter draft.	20%
2	**Intermediate Reports:** • <u>Good Practices Document:</u> A document detailing best practices for strengthening the use of new technologies for infrastructure resilience • <u>Repository of new technologies and Case Studies:</u> A collection of effective technologies for resilient infrastructure and their uses and global examples for evaluating and implementing such technologies.	15%
3	**Preparation of the background report:** The background report will be prepared, serving as the reference point for the summary chapter draft.	30%
4	**Summary Chapter on "Technologies for Resilient Infrastructure" for the Second Biennial Report:** A complete chapter on "Technologies for Resilient Infrastructure" for the Second Biennial Report is to be drafted and submitted, providing actionable insights and recommendations.	35%

20. Standards of quality

Information and data created according to the Scope of Work should follow internationally accepted standards and practices.

21. Other Terms & Conditions

- The proposals should be valid for 90 days after the final submission date.
- CDRI reserves the right to cancel this Request for proposal before or after the receipt of proposals or after opening the proposal and call for fresh proposals. CDRI also has the right to reject any proposal without assigning any reason.
- Proposals incomplete in any respect will not be considered.

The agencies are requested to submit their proposal through email to tender.projects@cdri.world by 23:59 hrs (IST) on 27 December 2024. Responses received after the stipulated time or not in accordance will be summarily rejected.

Please ensure that your proposal is sent **ONLY** to ABOVE MENTIONED **email ID** before the closing date & time. Proposals sent/copied to any other email ID (other than above) OR received after the bid closing date & time (mentioned above) will not be entertained.