CDRI
Coalition for Disaster Resilient Infrastructure

IRAX
Infrastructure Resilience Academic eXchange

Infrastructure Resilience Academic Exchange (IRAX)

Vision Document

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1. Overview

1.1 Introduction

Disaster resilient infrastructure (DRI) is vital for attaining the 2030 Agenda of Sustainable Development and the objectives of the Sendai Framework for Disaster Risk Reduction (SFDRR).[1] DRI systems will be instrumental in ensuring sustained access to critical services during geophysical and climate-induced extreme events, which have risen by 83 percent over the past two decades.[2] More than 7,300 major disaster events were recorded between 2000 and 2019, affecting 4.2 billion people and leading to a colossal loss of US$2.97 trillion.[3] Given the rising trend of climate induced disasters, the World Bank strongly recommends investments in DRI, which are likely to yield a 4:1 benefit-cost ratio.[4]

Academia can significantly contribute to DRI by integrating the theme into existing and new academic curriculums to ensure that graduates have the necessary skills and knowledge on the topic. Such professionals will help organisations to mainstream DRI actions into infrastructure planning, finance, construction, and maintenance.

Currently, most degree programmes offered by higher education institutions do not cover the topic of systemic resilience of infrastructure. Higher learning opportunities are often confined to specific infrastructure sectors, and within each sector there is a focus on asset-level resilience of infrastructure. A systems approach to disaster and climate resilient infrastructure should be integrative and multi-disciplinary. Hence, there is a need to foster an entire ecosystem of higher learning that encourages students and professionals to think and engage beyond the boundaries of their individual disciplines.

The Coalition for Disaster Resilient Infrastructure (CDRI) has conceptualized the Infrastructure Resilience Academic Exchange (IRAX) – a DRI-centric academic network that aims to create structured engagements with global academic institutions.

Given that 75 percent of the world's infrastructure is yet to be built,[5] IRAX's academic interventions have the potential to play a significant role. Through formulating and facilitating a robust, resourceful, responsive, and inclusive knowledge sharing system, IRAX aims to ensure future infrastructure projects have the capacity to recover from climate-induced shocks. Furthermore, IRAX seeks to position academia as a key global stakeholder in infrastructure resilience by offering value-added education, research opportunities, and professional development.

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[1] United Nations. (2021). Climate and disaster resilient infrastructure: Building resilience to future uncertainties and shocks. Accessed on 15 January 2024.
[2] EMDAT.
[3] UNDRR. (2020). The human cost of disasters: an overview of the last 20 years (2000-2019). Accessed on 16 January 2024.
[4] Hallegatte, S., Rentschler, J., & Rozenberg, J. (2019). Lifelines: The resilient infrastructure opportunity. World Bank Publications.
[5] ADB. (2019). Why Infrastructure Doesn't Have to Cost the Earth. Accessed on 31 January 2024 from https://www.adb.org/news/

1.2 Vision

Through leveraging academic and industrial networks for research and capacity development, IRAX seeks to create a cadre of industry-ready professionals with DRI capabilities to enhance infrastructure resilience across CDRI member countries.

1.3 Objectives of IRAX Programme

1. **Curating** opportunities for higher education and research in climate and disaster resilient infrastructure
2. **Catalyzing** research on innovative solutions for DRI and its application in real-world scenarios
3. **Creating** a cadre of industry-ready infrastructure professionals in DRI

Different countries possess different degrees of academic strengths. IRAX will promote inter-university cooperation and access to shared knowledge and resources across CDRI member countries (see Theory of Change in Annex 1).

2. The Need for IRAX

Academia, with its non-monolithic character, consists of numerous levels and disciplines, as well as a diversity of pedagogies and degree programmes to meet the multiple interests and demands of students and industry. In some countries and regions, higher education is also heavily regulated by governments in accordance with their educational goals and research priorities. This can make it more challenging to integrate DRI into academia.

Despite this, academia, as a global stakeholder in sustainable human progress, offers unique opportunities. It can foster a bottom-up understanding of multi-faceted DRI systems, which encompasses policies, governance structures, institutional and financial strategies, technological planning, design, operation, and maintenance – all aimed at tackling climate and disaster induced risks.[6] Furthermore, academia can facilitate partnerships among universities, governments, and industries to develop and implement core DRI principles that can be adapted across disciplines.

CDRI strategically leveraged the International Conference on Disaster-Resilient Infrastructure (ICDRI) in 2023 and 2024 as a global platform to conduct consultations with key stakeholders from academia on the IRAX programme to help frame its objectives and focus areas. These consultations revealed critical gaps in existing curriculums and pedagogy, including a lack of substantive discussions on systemic infrastructure resilience and multi-disciplinary approaches. The consultations also found: (i) an inadequate emphasis on DRI and disaster risk reduction (DRR) in higher education policies; (ii) limited research on embedding and enhancing infrastructure resilience; (iii) unavailability of curricula focused on DRI concepts; (iv) a lack of trained educators; and (v) a lack of capacity building programmes for mid-career professionals.

Beyond addressing the overarching need for DRI-centric higher learning ecosystems, the need to design strategic programme objectives for IRAX, that satisfy employability, industry acceptance of trained professionals, and value addition to the growing DRI job market, was also highlighted during regional ICDRI and ICDRI 2024 consultations. Suggested focus areas for program design include: (i) DRI integration in existing curricula; (ii) project-based learning for DRI; and (iii) knowledge, skills, and capacity building for DRI.

Integrating DRI into academia presents a complex puzzle due to systemic heterogeneity and resource limitations. The IRAX programme can bridge this gap by fostering knowledge exchange and curriculum development.

[6] UNDRR. (2022). Principles for resilient infrastructure. Accessed on 30 January 2024 from https://wrd.unwomen.org/

3. IRAX Initiatives

In line with consultations with key stakeholders, IRAX intends to undertake the following initiatives for mainstreaming DRI research, learning, and practice using a multi-disciplinary and inclusive approach.

3.1 A University Consortium on DRI (IRAX-UC)

The first step towards operationalizing IRAX will be creating the IRAX-University Consortium (IRAX-UC) to support all CDRI programmes. CDRI will follow a well-structured and focused approach to engage universities across the entire DRI spectrum to strengthen already established and valuable connections with various academic institutions.

IRAX-UC will allow inter-university cooperation across CDRI member countries. It will provide a global platform for academic institutions to interact and collaborate on DRI research, curriculum development, capacity building, student and faculty exchanges, and other academic initiatives. It will be CDRI's vehicle to solicit inputs on its work and seek support in advancing its advocacy initiatives within member countries. Through strategic engagement plans, IRAX-UC will:

a) **Leverage existing strengths**: Identify universities with established research and teaching programs in DRI. Partnering with these institutions will allow IRAX to harness their expertise and establish best practices for the network.
b) **Empower new DRI champions**: Engage universities that are keen to incorporate DRI into their academic offerings. IRAX will provide these institutions with valuable resources, support curriculum development, and offer student and faculty training opportunities.

Once IRAX-UC is established, all academic engagements of CDRI will only be available for universities through IRAX-UC.

It is also envisaged that IRAX-UC will gather existing university consortiums which are engaged on disaster resilience under the one umbrella. These consortiums will be able to join IRAX-UC through their nodal/key university.

3.2 Training and Capacity Building of Faculty and Professionals on DRI

Effective delivery of DRI curricula will require trained faculty members within the universities to be able to teach effectively to students at all academic levels, specifically in a multi-disciplinary setting. The IRAX programme aims to support Training of Teachers (TOT) programmes for university faculty members.

IRAX also envisions to influence the entire ecosystem of infrastructure sector employment by creating opportunities for early and mid-career infrastructure professionals through systematic, customized, and targeted training and capacity building programmes. IRAX aims to work with university partners to create short- and long-term executive programmes for officials of CDRI member countries, as well as e-courses and other kinds of online programmes targeting a range of infrastructure stakeholders including students, faculties, policymakers, financiers, engineers, and DRR professionals. This will help to develop 'resilience thinking' and a detailed understanding of the principles of disaster resilient infrastructure.

3.3 A Globally Applicable DRI Model Curriculum

IRAX aims to create a model curriculum which enhances the global understanding of the intersectionality between two critical concepts: infrastructure and resilience. By means of this curriculum, academia can set up a trained cadre of competent professionals (engineers, planners, architects, financial managers, social scientist, and other stakeholders) to respond to the complex systemic challenges around the resilience of existing and new infrastructure systems. The model curriculum can be used to structure content, for faculty members to offer new courses or embed DRI principles into existing courses, or for universities and academic institutions to create entire certificate or degree programmes on DRI.

3.4 Research, Fellowships, and Learning Initiatives

IRAX will undertake a variety of academic initiatives that will involve members of IRAX-UC. These initiatives will offer scope for both short- and long-term collaborations among the members of the consortium.

3.4.1 Fellowships

CDRI promotes cutting edge research and provides support to research fellows. In September 2020, CDRI launched the Fellowship Programme with a vision to develop a multi-disciplinary pool of professionals who will help shape a resilient future for global infrastructure systems. IRAX may be leveraged through the CDRI Fellowship Programme to support selected researchers from IRAX-UC or specific fellowships may be provided as per the requests of member countries.

3.4.2 Resilience Centres

Resilience centres are long-term collaborative instruments for cutting edge research on contemporary DRI themes. Centres may be based in any university which is part of IRAX-UC. Themes that will be explored include:

- Data science for DRI – Centres may support the development of risk assessments, methodological frameworks, data collection, and assessment tools for accurate estimations and predictions of disaster risk. This may include supporting CDRI member countries and institutions in evidence-based and risk-informed decision making for better infrastructure policy, governance, and finance. CDRI has already developed a global data platform called GIRI.[7] The centres may support enrichment and localisation of the platform in the future.
- Finance for DRI – Financing DRI as a part of adaptation finance commitments requires better financial models that take into consideration risks of hazards and their possible impacts to reduce average annual loss (AAL). Centres may explore the development of tools to support innovative financing mechanisms (such as blended finance for monetizing the resilience dividend) and attracting investment for disaster resilient infrastructure for reducing the overall impact of disasters.[8]
- Governance for DRI – Centres may expand research on governance policies that are cross-sectoral, reflexive, transparent, and place emphasis on learning outcomes that could be disseminated through institutionalized programmes

[7] More information on CDRI's GIRI Data platform can be accessed at https://cdri.world/giri

[8] LLOYD's. (2018). Innovative finance for resilience infrastructure. Accessed on 20 February 2024 from https://www.lloyds.com/news-and-insights/risk-reports/library/innovative-finance-for-resilient-infrastructure

and platforms.[9] They may work towards creating better guidelines which will help governments to: (i) prioritize infrastructure needs and management; (ii) improve capacity and resourcing; (iii) create clarity in relation to infrastructure regulations, codes, and standards; and (iv) boost access to data information and technology.

- Sectoral research for DRI – Power, telecommunications, transport, health, and urban infrastructure sectors are prime research areas for CDRI. These sectors are part of a larger infrastructure system that must be sufficiently robust to enable long-term societal and economic resilience against geophysical and climate-induced disasters. The aim is for this research to be integrated and shared between sectors.
- Nature-based solutions supporting DRI – Nature-based solutions (NBS) are recognized as one of the most important transitional strategies for developing resilient and sustainable infrastructure, contributing to sustainable goals.[10] Insufficient economic support due to the ambiguity of the performance and benefits of NBS has been one of the major constraints preventing their adoption in disaster resilient plans. By improving an understanding of how NBS can be integrated into grey infrastructure and policy, IRAX aims to assist in removing key barriers so that NBS can become an integral part of DRI strategies.

Opportunities within this initiative include, but are not limited to, DRI-centric PhD research, student exchange programmes, development of e-learning materials for DRI Connect,[11] DRI course development, and fully-fledged degree programs on DRI. Resilience Centres must employ solid reasoning before proposing new thematic focus areas.

3.4.3 Resilience Living Labs

Resilience living labs will offer opportunities for consortium universities to embed DRI learning into ongoing courses. This will include, but is not limited to, activities such as field trips to learn from disasters and observing infrastructure resilience practices in existing assets. Expected outputs could include vulnerability assessments, case-studies, statistical compendiums, poster exhibitions, video documentaries, and webinar series.

3.5 Industry-University Connect on DRI

Infrastructure resilience challenges across the entire life cycle of assets are primarily understood by industry stakeholders within the various infrastructure sectors. Therefore, any updates to university curricula should be informed by the skills needed by the specific industry. IRAX envisages that all curricula and training modules will include insights from industry, and any research conducted aims to directly address industry needs. IRAX will facilitate universities in strengthening their partnerships with industry, aiming to seamlessly integrate industry perspectives into academic endeavours.

[9] Kannan, A. (2021). Governance of Infrastructure for Resilience. Accessed on 20 February 2024.
[10] Debele, S. E,. et al. (2023). Nature-based solutions can help reduce the impact of natural hazards: A global analysis of NBS case studies. *Science of the Total Environment*, *902*, 165824.
[11] CDRI's platform for DRI discussions and learning.

4. The Operationalization of IRAX

All IRAX initiatives, including the university consortium, will be governed by a Steering Committee under the chairmanship of the CDRI Director General. The Committee will include university consortium members, donor organisations, regional/UN organisations, multi-development banks, DRI/industry experts, and practitioners. All members will be nominated by the CDRI Secretariat.

As IRAX is envisaged as the only method for CDRI to take forward its academic engagements, all CDRI programmes can utilise IRAX modalities for reaching their objectives. Outputs produced under IRAX will further inform CDRI's programmes and initiatives.

4.1 The CDRI Secretariat

Located in New Delhi, India, the CDRI Secretariat will serve as the central administrative unit for IRAX-UC. The Secretariat will be responsible for addressing the logistical requirements of IRAX-UC, including maintaining a dataset of universities and resource points, facilitating new joiners, issuing Call for Proposals (CFPs), as well as organizing meetings of the Steering Committee and other activities like workshops and seminars involving members of the consortium.

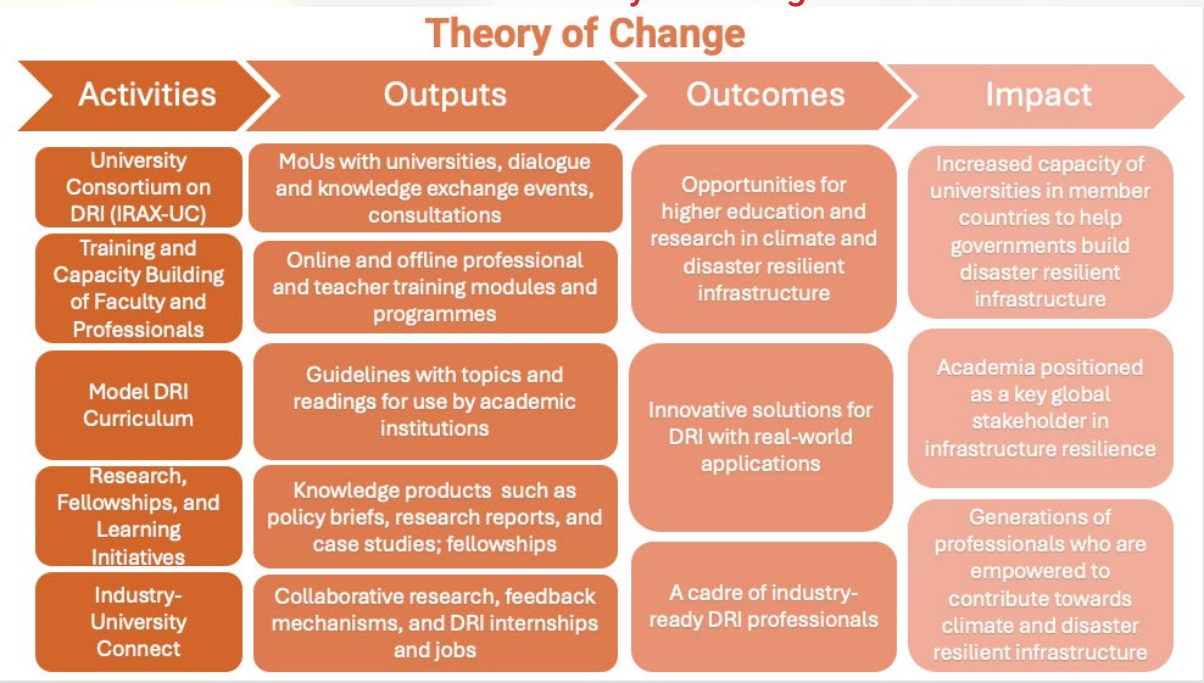
4.2 The Role of the IRAX Steering Committee

- **Advising the Secretariat:** The Committee shall provide guidance on IRAX initiatives, ensure their alignment with larger IRAX objectives and CDRI's programmatic initiatives, review programme and operational documents, and suggest priority intervention areas and important DRI themes.
- **Monitoring research progress:** The Committee shall review submitted proposals after initial screening and recommend finalized proposals for funding. The Committee shall monitor and evaluate the progress of the ongoing projects and recommend appropriate actions to the Secretariat wherever necessary.
- **Endorsing IRAX-UC:** The Committee shall promote IRAX and its initiatives among partners, peers, and fellow researchers, and support resource mobilization efforts for IRAX.

4.3 Strategic Initiatives and Funding Partnerships

CDRI will periodically develop strategic initiatives (in the form of CFPs) under the IRAX umbrella, providing support to consortium members. These initiatives will further support CDRI's agenda of mainstreaming DRI into academic discourse and align with the overall objectives of the IRAX program. Additionally, CDRI will collaborate with funders to leverage their priorities and support for thematic and regional research initiatives.

Annex 1: Theory of Change



About CDRI

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. CDRI functions as an inclusive multi-stakeholder platform where knowledge is generated and exchanged on different aspects of disaster resilience of infrastructure. The Coalition was officially launched by the Prime Minister of India at the UN Climate Action Summit in New York on 23 September 2019. For more information please visit: www.cdri.world.