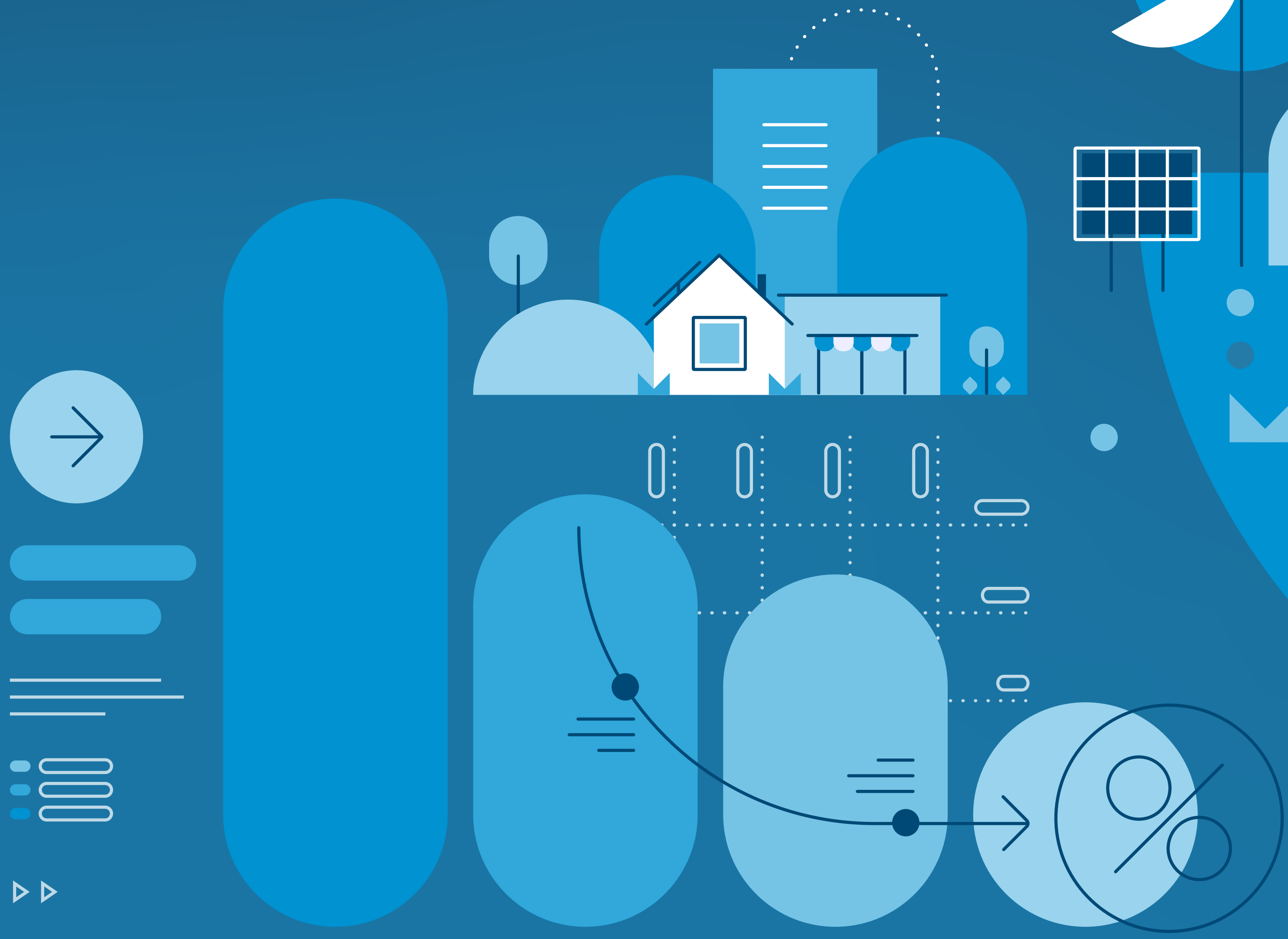
UNOPS

Scaling Infrastructure Resilience: A Suite of Tools for Resilient Infrastructure Planning



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For more information:
UNOPS website: www.unops.org

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Foreword

The world we live in is defined by interconnectedness. The challenges of climate change, natural disasters, and sustainable development transcend borders, and their impacts are most acutely felt by the world's most vulnerable populations. At the heart of our ability to respond to these challenges lies infrastructure—the essential foundation that supports societies, economies, and the achievement of the Sustainable Development Goals.

As practitioners in infrastructure and project management, we witness first-hand the daily complexities our partners face. Governments, particularly in low- and middle-income countries, are tasked with planning for a future of increasing uncertainty. The question has shifted from why we need resilient infrastructure to how we can plan and deliver it effectively, efficiently, and at the scale required. Decision-makers need more than just an awareness of the risks; they need practical, evidence-based tools to navigate them.

This publication, Scaling Infrastructure Resilience: A Suite of Tools for Resilient Infrastructure Planning, is a direct response to this need. It comes from a clear need for clarity in a crowded landscape of planning resources. Recognizing that a lack of capacity should not be a barrier to progress, our team has undertaken a rigorous analysis to identify a suite of tools that are not only useful but also adaptable, scalable, and accessible. This publication cuts through the complexity, offering a clear and actionable pathway for integrating resilience into the very core of national planning.

The tools and methodologies presented here are catalysts for transformative change. They empower governments and planners to conduct multi-hazard risk assessments, understand systemic vulnerabilities, and, most importantly, prioritize investments that will protect lives and livelihoods. By translating complex risk data into actionable insights, this work bridges the crucial gap between planning and implementation, helping to build a robust, evidence-based case for financing resilient projects. This is evidenced through the case studies featured here; they highlight that resilience is not an abstract concept, but a measurable, achievable outcome when supported by the right data, partnerships, and planning approaches.

At UNOPS, our mission is to help people build a more peaceful, fair and sustainable world. This publication is a testament to that commitment. I am confident it will serve as an invaluable resource for our partners, stakeholders, and colleagues across the globe. I encourage you to use it not just as a guide, but as a call to action. Let us work together to build the resilient infrastructure that will safeguard our communities and ensure a sustainable world for generations to come.

Steven Crosskey

Acting Director, Infrastructure and Project Management Group

UNOPS

Executive summary

Resilient infrastructure planning tools can help governments and planners, especially in low- and middle-income countries (LMICs), overcome capacity challenges and access evidence that informs decision-making and prioritization towards the development of more resilient national infrastructure systems. UNOPS, with its mandate in expanding partners' implementation capacity, has developed this report to identify tools that can bolster the capacity to speed up and scale up implementation for sustainable development, in order to achieve a safe world where no one is left behind.

With over 75 tools for resilient infrastructure planning available, this report aims to narrow the options down to establish a suite of tools that can be used individually or in combination to address the planning needs of governments in LMICs. Based on a study of tools that have the key functions and capabilities required by governments, financiers and infrastructure planners, UNOPS has curated a selection to support resilient infrastructure planning. The suite includes: (1) the **Global Infrastructure Risk and Resilience Index (GIRI)**, commissioned by the Coalition for Disaster Risk Infrastructure (CDRI); (2) the **UNDRR Stress Testing Tool**, developed by the UN Office for Disaster Risk Reduction (UNDRR); and (3) the **Systematic Risk Assessment Tool (SRAT)**, developed by the University of Oxford.

The tools are able to analyze the risk to and resilience of infrastructure systems, with a system-of-systems approach that considers multi-hazard risk across and between various infrastructure sectors. They have been selected based on the following capabilities: (1) **adaptability** for multiple infrastructure sectors and hazards; (2) **scalability** from subnational to global levels; and (3) **ease of adoption**.

The suite of tools can provide evidence to support risk-informed decision-making through: (1) the assessment of infrastructure vulnerability to current and future climate- and disaster-related impacts (such as loss and damage), (2) the identification of interventions to improve infrastructure resilience, and finally, (3) the costing and prioritization of these interventions. This has multiple applications, such as supporting the development of infrastructure strategies, plans and pipelines, National Adaptation Plans (NAPs), Nationally Determined Contributions (NDCs), National Development Plans, Multilateral Development Bank (MDB) country documents, and loss and damage determinations.

UNOPS stands ready to support governments in the planning, delivery and management of resilient infrastructure by supporting the implementation of these tools, as well as providing tailored solutions and project management support for the design, procurement, construction and asset management of infrastructure, including in fragile and conflict-affected regions.

1. Introduction

The impacts of climate change and disasters on infrastructure systems are slowing sustainable development, with disproportionate impacts in low- and middle-income countries. Infrastructure – which is the backbone for societal, economic and human development and underpins 92 per cent of the Sustainable Development Goals (SDGs)[1] – is threatened when planning systems do not account for climate- and disaster-related shocks and stresses. When these shocks and stresses cause infrastructure loss and damage, they also disrupt essential services and increase operating costs, causing an estimated global average annual loss (AAL) of over $700 billion, with 54 per cent of this borne by LMICs.[2]

In order to help people and the planet cope with the complex challenges of today and tomorrow, infrastructure systems need to be planned with resilience in mind. Vulnerability to climate- and disaster-related impacts is not just due to high exposure but also low capacity to adapt and respond – and resilient infrastructure plays a vital role in bolstering this adaptive capacity. As the first line of defence, infrastructure that is built to withstand these impacts can protect lives, minimize economic disruptions and mitigate environmental damage, resulting in a $4 benefit for each $1 invested in resilient infrastructure.[3] Additionally, resilient infrastructure also provides co-benefits such as reduced environmental degradation, less water and energy use, improved quality of life, as well as the improved capacity of communities to break cycles of poverty and inequality.

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The landscape of infrastructure resilience planning

Building infrastructure resilience is a key aspect of achieving global agendas on climate adaptation, disaster risk reduction and sustainable development. The need to develop resilient infrastructure is explicitly identified in Goal 9 of the 2030 Agenda, and it is a main target of the Sendai Framework for Disaster Risk Reduction 2015-2030. It also contributes to achieving climate adaptation goals outlined in the Paris Agreement, given that 88 per cent of adaptation costs are linked to infrastructure.[4]

However, many countries are still in the early stages of resilient infrastructure development and lack the capacity for data-driven decision-making that can address systemic risks. Infrastructure assets are vulnerable, not just to the direct impacts of natural hazards but also to cascading failures within and across the infrastructure systems they are embedded in. Despite growing understanding of the systemic nature of risk, there are still challenges in integrating complex interrelationships between hazards and risks in resilience assessments, especially in countries with insufficient financial resources, institutional knowledge or capacity. Aside from a lack of quality, interoperable or accessible data, countries may also lack the capacity to assess and interpret data for decision-making to inform resilience planning.[5]

Resilient infrastructure planning must incorporate elements that recognize the systemic nature of risk and the interconnectedness of infrastructure systems. This includes:

- **Systems thinking:** recognizing the interconnectedness of infrastructure systems and their dependencies.
- **A multi-hazard approach:** considering the impact of a range of potential shocks and stresses, not just single hazards.
- **Stakeholder engagement:** emphasizing the importance of involving relevant stakeholders, including vulnerable groups, throughout the assessment process.
- **Data-driven analysis:** highlighting the need for accessible, reliable and up-to-date data, and the capacity to use relevant analytical methods to strengthen evidence-based decision-making.
- **Context specificity:** recognizing that assessment approaches need to be tailored to the specific context, including the type of infrastructure, location and available resources.

Resilient infrastructure planning tools can help governments, especially in LMICs, strengthen evidence-based decision-making to prioritize resilient infrastructure investments. These tools can help overcome capacity challenges related to forecasting and assessing risks and can support scenario-based planning by simulating infrastructure performance under varying future conditions, whether they arise from geophysical, meteorological or hydrological hazards. They can also help decision-making by supporting cost-benefit analyses and investment prioritization, as well as by developing visualizations to help communicate findings and align stakeholders' needs and aspirations.

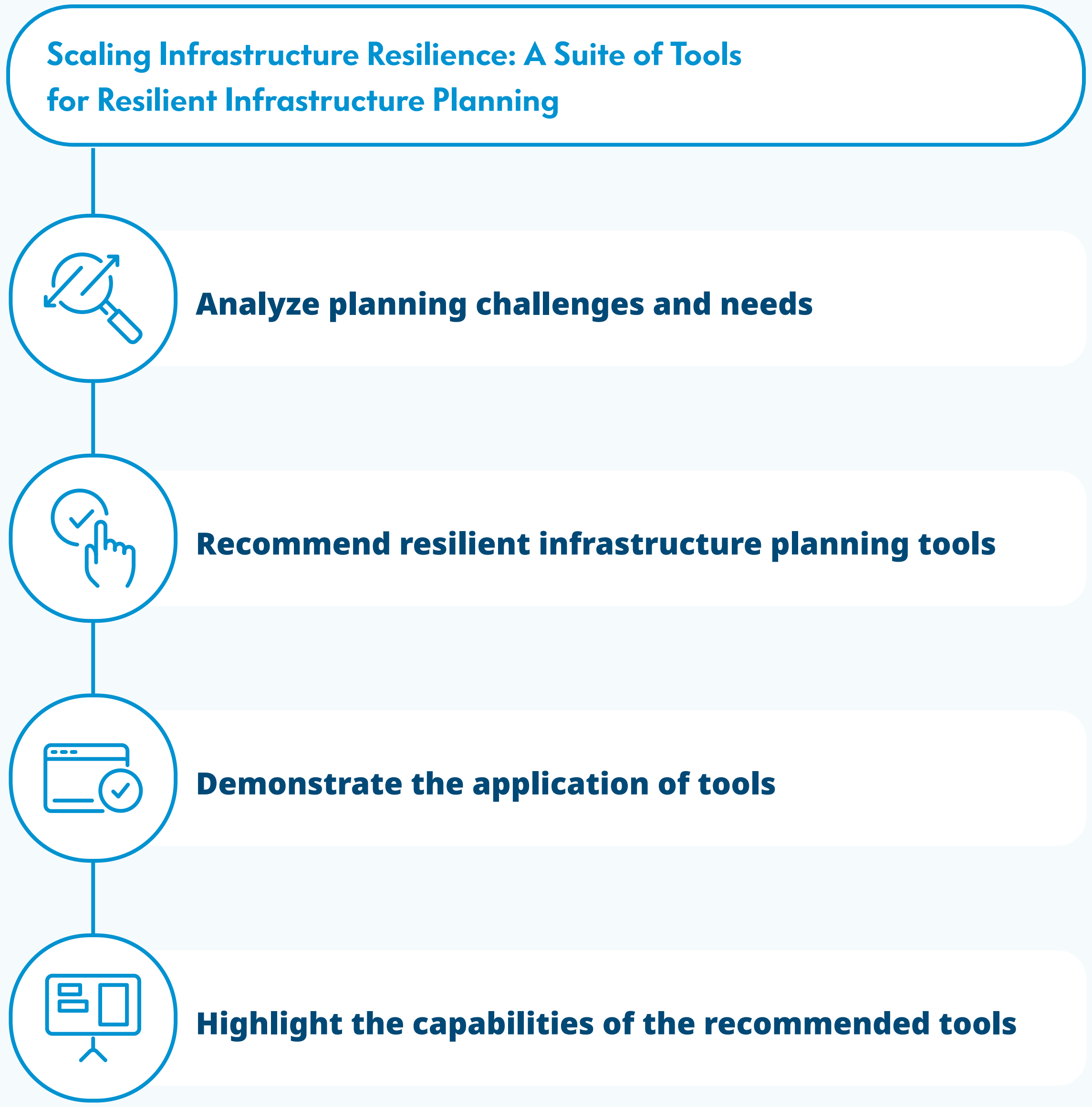
UNOPS, with its mandate in expanding infrastructure implementation capacity, has developed this report to identify tools that can help bolster the capacity to speed up and scale up the implementation of resilient infrastructure for sustainable development. This report identifies resilient infrastructure planning tools that can inform decision-making, prioritization of investments and interventions to meet planning needs. While various tools, methodologies and approaches for planning resilient infrastructure exist, there is a demand for the identification of planning tools that can adequately respond to the needs of governments in this period marked by the increasing frequency and severity of disasters.

Objectives of the report

This report brings together and **recommends a suite of tools that support resilient infrastructure planning while meeting the pressing needs of governments, infrastructure planners and financiers.** It:

- Analyzes the planning challenges and needs of governments and infrastructure planners in LMICs, as well as the needs of infrastructure financiers, in order to determine the tools' required functions, capabilities and applications.
- Recommends resilient infrastructure planning tools that have the required characteristics.
- Demonstrates the application of tools through case studies.
- Highlights the capabilities of the recommended tools to inform the development of infrastructure strategies, plans and pipelines, as well as National Adaptation Plans, Nationally Determined Contributions, National Development Plans, Multilateral Development Bank country documents, and loss and damage determination.

Figure 1: Objectives of the report



Methodology

The report is based on the findings of a two-phased methodology designed to understand the characteristics (key functions, capabilities and applications) that governments, infrastructure planners and infrastructure financiers require of infrastructure resilience planning tools and assess the current selection of tools that support these needs.

Figure 2: Methodology phases

Phase 1 Determine required characteristics of resilience planning tools

- **1.A Conduct stakeholder consultations**
  Consulted ten representatives from LMICs, multilateral development banks, development agencies, technical practitioners
- **1.B Develop shortlisting criteria**
  Identified the essential key functions of the tools based on stakeholder requirements
- **1.C Develop selection criteria**
  Developed a multi-criteria preference scale to select tools based on the capabilities desired by stakeholders

Phase 2 Analyze and select resilience planning tools

- **2.A Longlist tools**
  Compiled 79 infrastructure resilience planning tools from public repositories
- **2.B Shortlist tools**
  Selected six tools that are able to carry out the required functions
- **2.C Analyze and select tools**
  Analyzed the shortlist and selected three tools based on the multi-criteria preference scale
- **2.D Validation**
  Validated the tools' capabilities and applications with their owners

2. Required characteristics of resilient infrastructure planning tools

Given the complexities of resilience planning, it is important to understand the characteristics that governments, planners and financiers require of resilient infrastructure planning tools. Consultations with stakeholders revealed different considerations that inform the tool characteristics required, such as:

- It is important to understand both the risk to and the resilience of infrastructure systems.
- Countries and their infrastructure systems have different hazard exposures; hence, tools should be customizable to the specific country context.
- While local data may be missing at the country level, there should be ways to overcome inaccuracies when using global datasets.
- Infrastructure planning can be undertaken at different scales of governance within and across nations; hence, tools should be flexible in the various scales of systems analyzed.
- Countries may have different technical and financial capacities to acquire and use planning tools.

These considerations have been translated into required characteristics (key functions, capabilities and applications) for the selection and recommendation of tools.

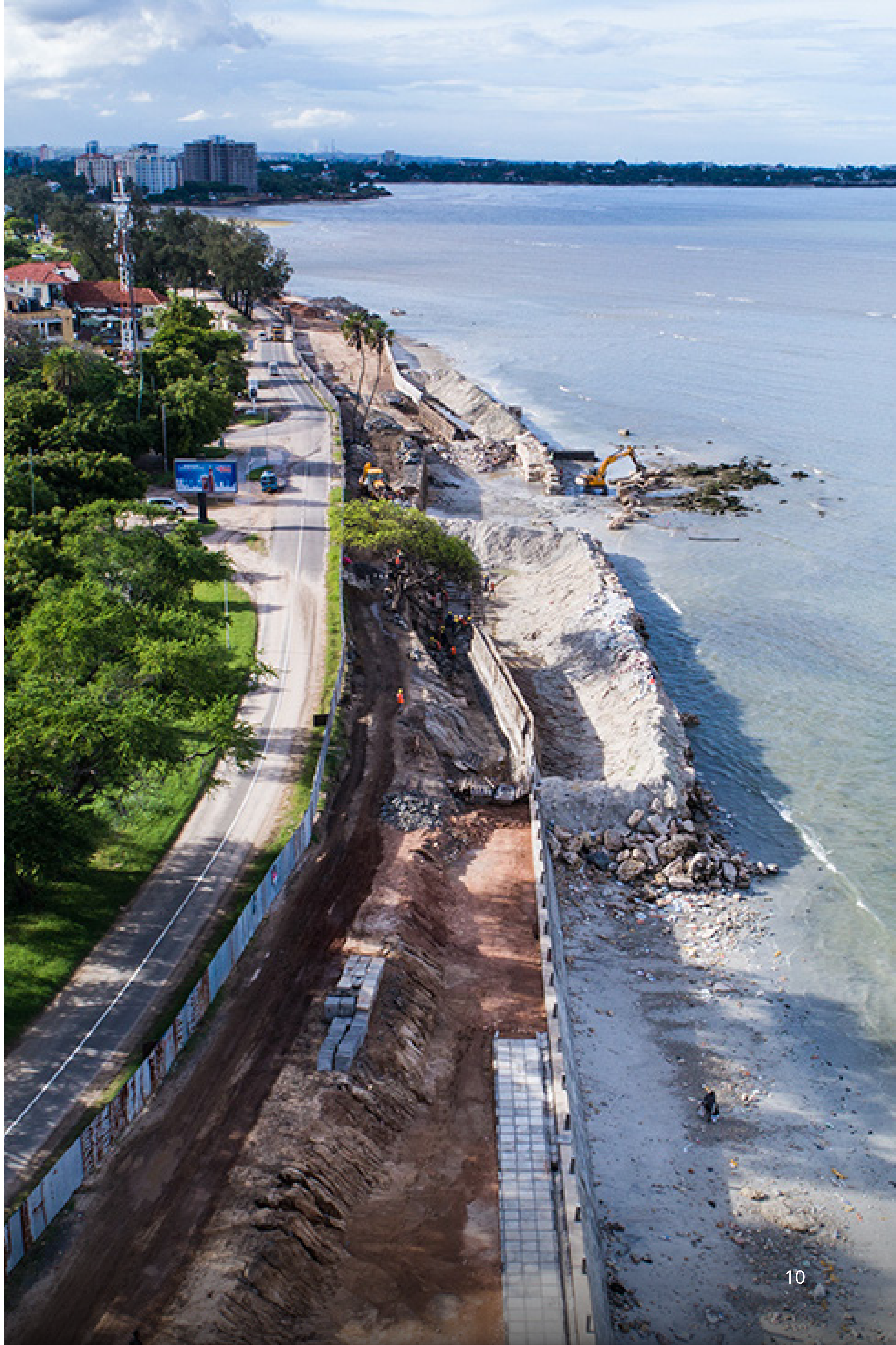


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Figure 3: Required characteristics of resilient infrastructure planning tools

Required key functions

The tools must be able to:

- Analyze risk to and resilience of infrastructure systems
- Analyze multihazard risk
- Assess multi- and cross-sectoral infrastructure risks
- Use a system-of-systems approach

Desired capabilities

The tools should preferably be:

- Adaptable
- Scalable
- Easy to adopt

Desired applications

The tools should preferably support:

- Assessing infrastructure vulnerability
- Identifying resilience interventions
- Costing and prioritizing interventions

Required key functions

The tools must be able to:

- **Analyze risk to and resilience of infrastructure systems:** the tools should analyze not only the exposure and vulnerability of infrastructure systems to risks, but also the ability of the systems to withstand, adapt to and recover from shocks and stresses.
- **Analyze multihazard risk:** the tools should be able to analyze multiple hazards that impact infrastructure systems.
- **Assess multi- and cross-sectoral infrastructure risks:** the tools should be able to identify risks across and between multiple infrastructure sectors.
- **Use a system-of-systems approach:** the tools should help identify the linkages and interdependencies between infrastructure systems in order to recognize cascading effects and complex interactions.

Desired capabilities

The tools should preferably be:

- **Adaptable:** they should preferably be customizable according to the various infrastructure sectors and hazards that different country contexts are exposed to, avoiding one-size-fits-all models.
- **Scalable:** they should preferably support infrastructure assessments across regional, national and subnational scales, recognizing that some countries have planning systems across different scales.
- **Easy to adopt:** they should preferably be acquirable at a low cost and operated with minimum specialist skills and expertise, without compromising comprehensiveness and accuracy. Where available, the tools should prioritize location-specific data over global datasets to improve accuracy.

Desired applications

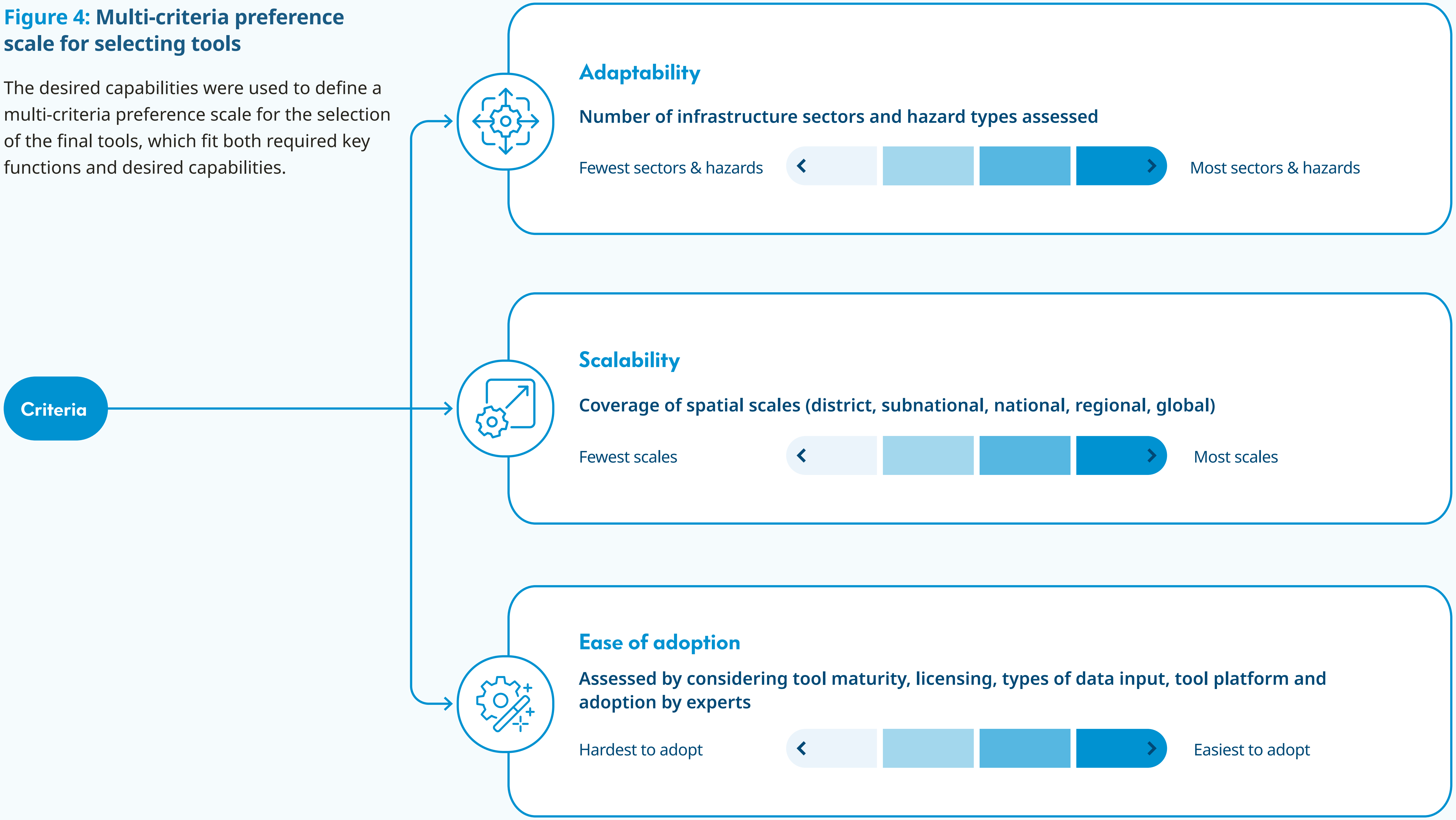
The tools should provide evidence and results that can support multiple applications, such as the development of infrastructure strategies, plans and pipelines, as well as NAPs, NDCs, National Development Plans, MDB country documents, and loss and damage determinations.

This includes:

- **Assessment of infrastructure's vulnerability to climate- and disaster-related impacts,** which can provide:
  - **Input to climate strategies:** can model infrastructure emissions as well as climate risks to inform the preparation of NDCs and NAPs in alignment with the Paris Agreement.
  - **Input to country diagnostics and development frameworks:** contributes evidence that informs engagement with MDBs (such as the preparation of Country Climate and Development Reports, Systematic Country Diagnostics), Common Country Assessments and the United Nations Sustainable Development Cooperation Framework. This would potentially incorporate Geographic Information System (GIS) data and spatial analysis.
- **Identification of interventions to improve infrastructure resilience,** which can support:
  - **A holistic approach to sustainable development and just transition:** contributes to identifying synergistic solutions for the achievement of various SDG targets towards facilitating a just transition, such as identifying ways to improve access to affordable renewable energy for marginalized communities.
  - **Identification of climate co-benefits:** can identify opportunities to increase climate adaptation and mitigation co-benefits from infrastructure projects.
- **Costing and prioritization of these interventions** by providing evidence that can enable financing and implementation, through methods such as:
  - **Economic benefits analysis and financing strategies:** can quantify the economic benefits of resilient infrastructure in order to support feasibility studies and project financing, as well as determine optimal financing strategies for infrastructure pipeline projects.
  - **Loss and damage quantification:** supports in assessing climate-related losses for compensation and insurance.

Figure 4: Multi-criteria preference scale for selecting tools

The desired capabilities were used to define a multi-criteria preference scale for the selection of the final tools, which fit both required key functions and desired capabilities.



3. Comparison and application of resilient infrastructure planning tools

Resilient infrastructure planning tools refer to methods, frameworks and models that help assess and plan infrastructure systems to allow them to withstand, adapt to and recover from disruptions arising from climate- and disaster-related shocks and stresses. These tools adopt a systems approach that allows for the assessment of multi-hazard-related risks across and between multiple infrastructure sectors.

Based on the analysis and methodology adopted, UNOPS recommends the following resilient infrastructure planning tools:

- **Global Infrastructure Risk and Resilience Index (GIRI),** commissioned by the Coalition for Disaster Risk Infrastructure (CDRI)
- **UNDRR Stress Testing Tool,** developed by the UN Office for Disaster Risk Reduction (UNDRR)
- **Systematic Risk Assessment Tool (SRAT),** developed by the University of Oxford

These tools are recommended based on characteristics that best respond to the required functions, desired capabilities and preferred range of applications expressed by stakeholders.

Table 1 summarizes and compares the tools in terms of their **adaptability** in analyzing a wide range of infrastructure sectors, subsectors and hazards, **scalability** in supporting analyses at local, subnational, national, regional and global scales, and **ease of adoption** with minimal constraints regarding costs, user expertise and data required, while still providing relevant results.

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Table 1: Comparison of recommended tools across desired tool capabilities

Desired tool capability		GIRI (CDRI)	Stress Testing Tool (UNDRR)	SRAT (Oxford)
Adaptability				
Sectors covered	Transportation	Yes	Yes	Yes
	Energy	Yes	Yes	Yes
	Water and sanitation	Yes	Yes	Yes
	Digital communications	Yes	Yes	No
	Solid waste management	No	Yes	No
	Buildings (e.g., health and education facilities)	Yes	Yes	Yes
Hazards covered	Meteorological and hydrological hazards (e.g., tropical cyclones, drought, floods and heatwaves)	Yes	Yes	Yes
	Geohazards (e.g., earthquakes, tsunamis, volcanic eruptions)	Yes	Yes	No
Scalability				
Applicable scales	District	No	No	Yes
	Subnational	No	Yes	Yes
	National	Yes	Yes	Yes
	Regional	Yes	Yes	Yes
	Global	Yes	No	Yes
Ease of adoption				
Data sources	Secondary/open data	Yes	n/a	Yes
	Primary data	n/a	Qualitative data	Spatial Data
Access	Platform	Web-based	Spreadsheet-based	Web-based/ downloadable Python script
User expertise required	To operate	General expertise	General expertise	Coding expertise
	To interpret results	Technical expertise	Technical expertise	Technical expertise

Table 2 summarizes the range of applications of the analysis generated by the tools, such as: (1) the assessment of infrastructure's vulnerability to current and future climate- and disaster-related impacts (such as loss and damage), (2) the identification of interventions to improve infrastructure resilience and (3) the costing and prioritization of these interventions.

Table 2: Summary of applications supported by the tools

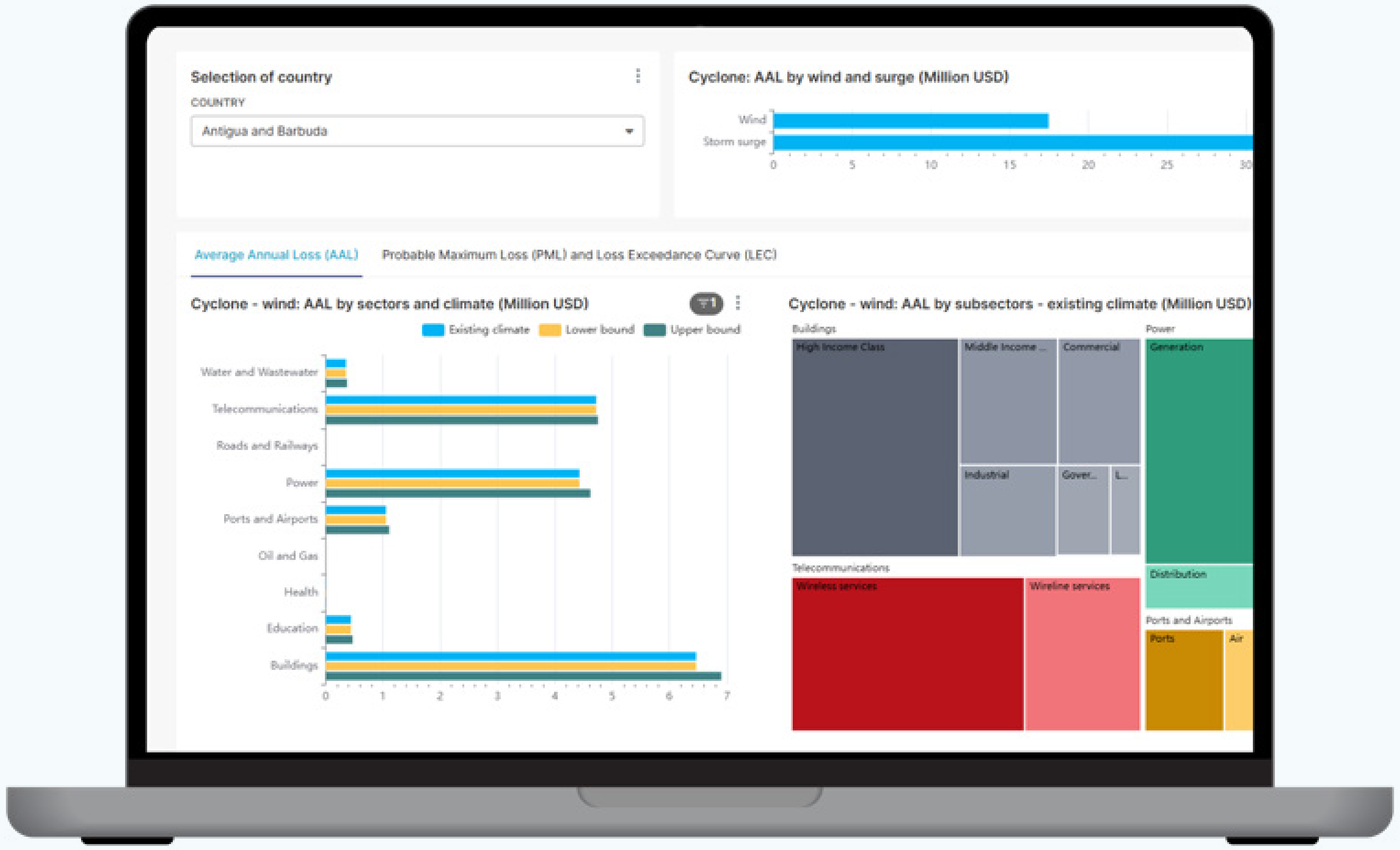
Area of application	Type of analysis	GIRI	Stress Testing Tool	SRAT
National Adaptation Plan (NAP) preparation	Analysis of current and future climate trends and climate hazards	Yes	Yes	Yes
	Assessment of infrastructure vulnerability	Yes	Yes	Yes
	Identification of adaptation interventions	No	No	Yes
Preparation of Nationally Determined Contributions (NDCs)	Identification of climate impacts	Yes	Yes	Yes
	Assessment of infrastructure vulnerability	Yes	Yes	Yes
	Identification of sectoral climate adaptation interventions	No	No	Yes
	Costing of adaptation interventions	No	No	Yes
National Development Plans	Identification of economic impacts of climate change	Yes	Yes	Yes
	Assessment of infrastructure vulnerability	Yes	Yes	Yes
Infrastructure strategies, plans and pipeline	Models take into account current and future climate hazards	Yes	Yes	Yes
	Assessment of infrastructure vulnerability	Yes	Yes	Yes
	Identification of interventions for resilience and mitigation	No	No	Yes
	Prioritization of interventions	No	No	Yes
Multilateral Development Bank (MDB) country documents	Assessment of infrastructure vulnerability	Yes	Yes	Yes
	Spatial modelling and visualization of climate hazards, vulnerabilities and infrastructure interventions	Yes	No	Yes
Loss and damage determination	Identification of climate impacts	Yes	Yes	Yes
	Assessment of infrastructure vulnerability	Yes	Yes	Yes
	Quantification of economic and non-economic losses	Yes	No	Yes

Global Infrastructure Risk Model and Resilience Index

Commissioned by the Coalition for Disaster Resilient Infrastructure, with administrative support from the UN Development Programme (UNDP), the Global Infrastructure Risk Model and Resilience Index is a unique data platform that provides detailed risk information on the potential impacts of geological and hydro-meteorological (including climate forcing) hazards on critical and social infrastructure sectors. GIRI is a probabilistic model and covers the impact of seven major climate and geological hazards and climate change on nine different critical infrastructure sectors. This national-level risk information is expressed by the two main metrics of GIRI – average annual loss (AAL) and probable maximum loss (PML).

The AAL data provided by GIRI can be used by country governments to estimate the allocation of resources for their contingency planning, to improve infrastructure codes and standards, and to prioritize long-term infrastructure investments with a focus on climate adaptation and resilience.

CDRI is now using GIRI data to inform its Fiscal Risk Assessment (FRA) study, for which it is being utilized to estimate the direct physical risks posed to infrastructure assets in four countries. GIRI data is also being used by the governments of Bhutan, Chile, Ghana, Madagascar and Tonga, as well as the International Water Management Institute, the Economic and Social Commission for Asia and the Pacific (ESCAP) and UNDRR.



Global Infrastructure Risk Model and Resilience Index interface © CDRI

CASE STUDY 1

Regional analysis of small island developing states

YEAR OF PROJECT

2025

SCALE

Regional – 55 small island developing states and Associate Members

RESOURCES

- Access GIRI at Coalition for Disaster Resilient Infrastructure, 'Global Infrastructure Risk Model and Resilience Index', <https://giri.unepgrid.ch/>.
- Read more about the analysis: Coalition for Disaster Resilient Infrastructure, 'Global infrastructure Resilience Working Paper: Infrastructure Resilience in Small Island Developing States', CDRI, 2025.

CONTEXT AND CHALLENGE

Island states are particularly susceptible to geological and climate-related disasters, including sea level rise and temperature variations. Their small land size and economies make them vulnerable to livelihood and economic impacts caused by disasters. As information and insights about risks to their infrastructure are scarce, CDRI used GIRI data to develop a deeper regional-level analysis of the risks to infrastructure sectors in small island developing states (SIDS) and territories.

TOOL APPLICATION

Data for 55 SIDS and Associate Members was accessed from the GIRI data platform, and four regional groupings – the Caribbean, Pacific, AIMS (Atlantic, Indian Ocean, Mediterranean and South China Sea) and SIAM (Small Island Associate Members) – were created. By disaggregating the SIDS-specific AAL data by hazard and infrastructure sector, regional differences within SIDS were identified. This analysis informed the call to action by CDRI to accelerate efforts towards building the resilience of infrastructure systems in SIDS.

OUTCOMES

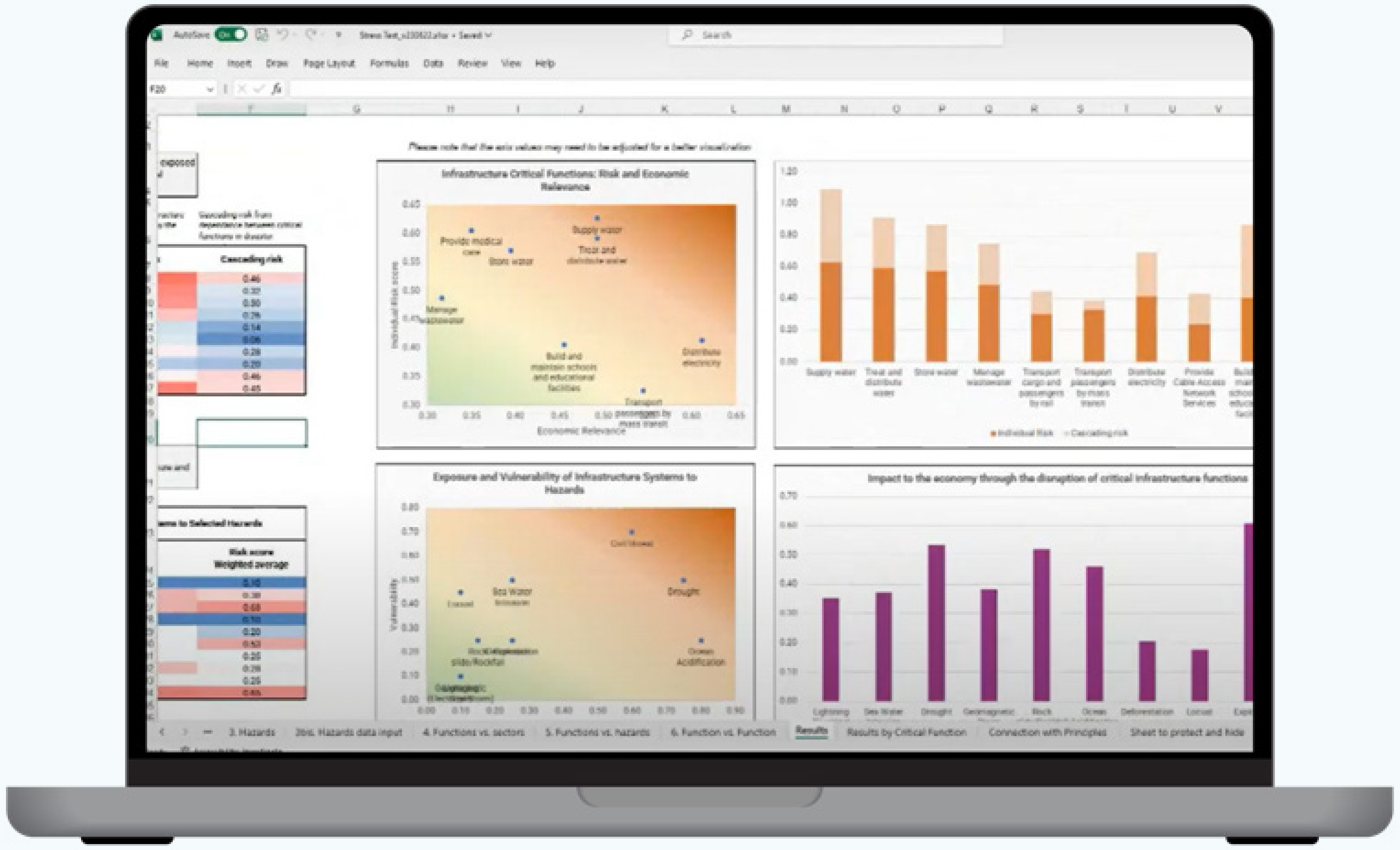
The analysis revealed that:

- SIDS exhibit higher absolute and relative AAL, indicating greater vulnerability to climate hazards. Cyclones and hurricanes cause 62 per cent of AAL in SIDS, with earthquakes and flooding accounting for another 35 per cent, emphasizing the need to prioritize these hazards in efforts to build resilience.
- The power, telecommunications, and roads and railways sectors account for 83 per cent of AAL in SIDS. The analysis provided crucial data for finance and infrastructure ministries regarding direct average losses from infrastructure damage.
- Regionally, SIAM nations and Caribbean islands have the highest AAL, attributed to their larger infrastructure stocks, which are linked to their size, economic development and populations.

UNDRR Stress Testing Tool

The UNDRR Stress Testing Tool supports governments in understanding vulnerabilities, identifying system interdependencies, considering barriers to improve the allocation of resources, and assessing the state of critical infrastructure at the national level. The tool is implemented through participatory processes that enhance system resilience by evaluating the capacity to endure systemic and targeted shocks, and it adapts to varying levels of risk data. Stress testing will strengthen the capacity for risk-informed infrastructure planning and development, ensuring infrastructure systems are strengthened to withstand a wide range of hazards.

The stress testing tool is also part of the Global Methodology for Infrastructure Resilience Reviews, developed by UNDRR and CDRI. The data from GIRI supported the application of the stress testing tool in Chile. Going forward, the stress testing tool aims to further incorporate climate scenarios and data from probabilistic models.



Stress Testing Tool interface © UNDRR

CASE STUDY 2

Identification of system vulnerabilities and interdependencies in Chile

PARTNERS

Government of Chile, Chile's National Service for Disaster Prevention and Response (SENAPRED), CDRI, International Coalition for Sustainable Infrastructure

YEAR OF PROJECT

2023-2024

SCALE

National and subnational – Chile

RESOURCES

Read more about the methodology:
UN Office for Disaster Risk Reduction and Coalition for Disaster Resilient Infrastructure, *Global Methodology for Infrastructure Resilience Review*, UNDDR and CDRI, 2023.

CONTEXT AND CHALLENGE

Chile, with a strong economy and nearly 20 million people, spans from the tropics to Antarctica. Its vital infrastructure – supporting water, energy, transport, digital communications, health and education – is exposed to hazards such as earthquakes, floods, tsunamis, droughts and fires. Climate change intensifies these risks, which are compounded by Chile's diverse geography and socioeconomic conditions, posing challenges to the country's resilience. Disruptions can cascade through interconnected systems, affecting multiple sectors and exacerbating impacts.

TOOL APPLICATION

The stress testing tool's implementation brought together key infrastructure stakeholders across various line ministries to discuss and identify infrastructure systems' vulnerabilities and interdependencies. This helped identify current gaps and opportunities for policy development, resource allocation and action for the improved integration of resilience into national regulatory frameworks and infrastructure projects. Carried out in collaboration with SENAPRED, the stress testing exercise identified water scarcity and drought as emerging critical risks. These threats are now prioritized on the national critical threats list, with efforts underway to strengthen institutional capacity to effectively address them.

OUTCOMES

The process revealed the complexity of interconnected infrastructure systems and the importance of working collaboratively across sectors, governance levels and data systems. Stress testing of critical infrastructure supported Chile in strengthening its infrastructure resilience through:

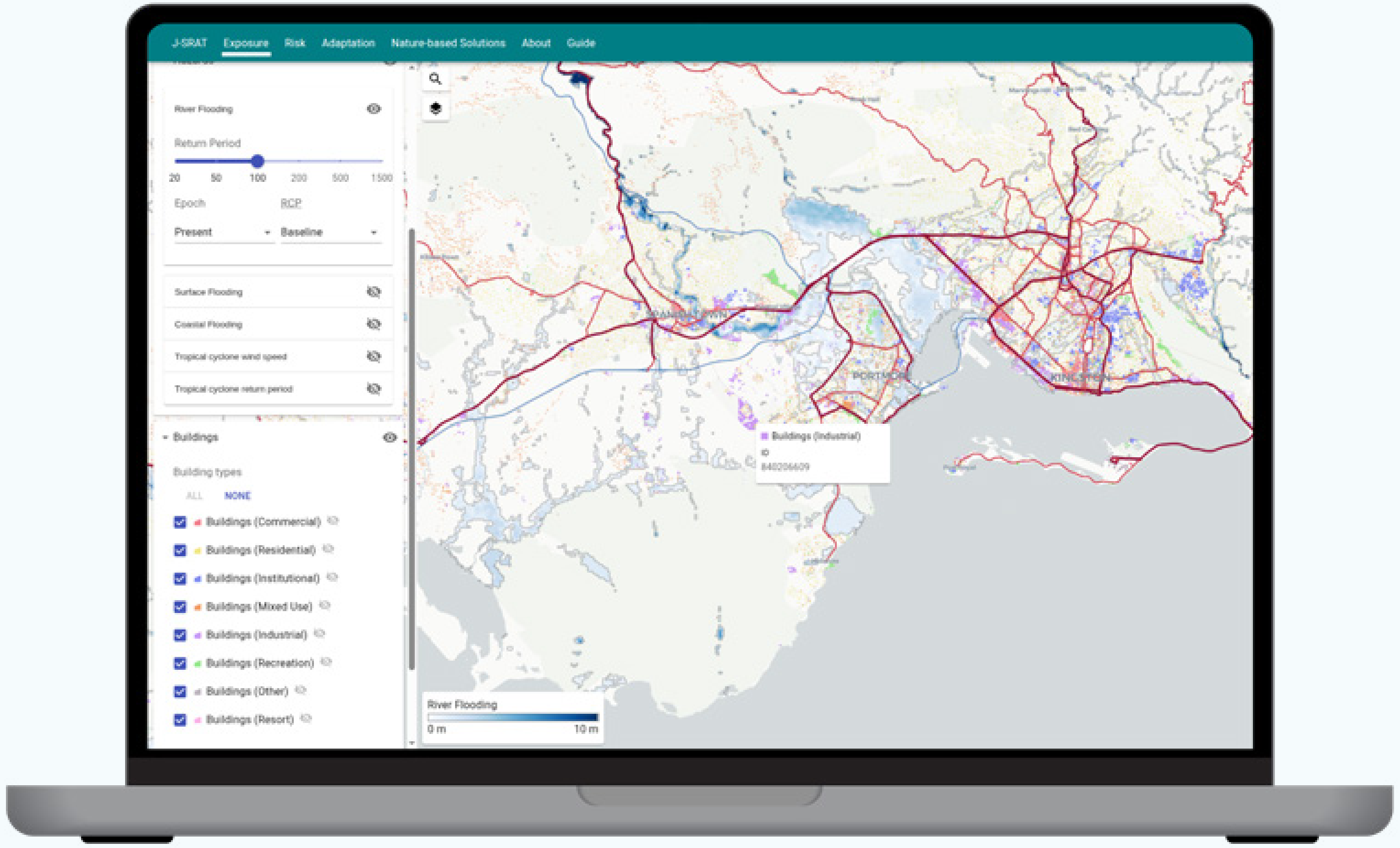
- Increased awareness and understanding of infrastructure vulnerability and resilience, sectoral interdependencies and cascading risks among key infrastructure stakeholders.
- Strengthened national capacity for risk-informed infrastructure planning among diverse infrastructure actors.
- Strengthened sectoral capacity for risk-informed infrastructure planning across the energy, information and communications technology (ICT), transport and water sectors.
- Enhanced collaboration between infrastructure stakeholders to address infrastructure vulnerability and resilience, which included the institutionalization of a cross-sectoral working group on disaster risk reduction and critical infrastructure resilience, supported by a Resilience Academy.
- Reinforced risk-informed decision-making through the collaborative design and piloting of an integrated data centre and a monitoring and evaluation system for risk and resilience management.

The national stress testing exercise also identified the need for subnational-level assessments, given Chile's vast geography and the diverse hazards affecting different regions. As a result, a subnational stress testing exercise was conducted for the Biobío Region, and an intersectoral working group was formalized under the Regional Platform for Disaster Risk Reduction.

Systemic Risk Assessment Tool

Developed by the University of Oxford, the Systemic Risk Assessment Tool supports climate adaptation decision-making by identifying spatial criticalities and risks under current and future climate scenarios. SRAT provides a sophisticated analysis of cascading failures and networks, and it is capable of analyzing the wider economic impacts of infrastructure failure at varying scales. The base tool, i.e., SRAT, is customizable for different scales and contexts, resulting in a global version called G-SRAT, which forms the basis of the Global Resilience Index Risk Viewer and customized versions applied in East Asia, Jamaica and East Africa.

Systemic Risk Assessment Tool interface © University of Oxford



CASE STUDY 3

Jamaica Systemic Risk Assessment Tool

PARTNERS

The Planning Institute of Jamaica, The University of the West Indies, the Caribbean Community Climate Change Centre

YEAR OF PROJECT

2020-present

SCALE

National – Jamaica

RESOURCES

- The open-source code for J-SRAT is available at GitHub, 'Jamaica Infrastructure Risk and Resilience Assessment', <https://github.com/nismod/jamaica-infrastructure>.
- The global version of the tool, G-SRAT, is available at GRI Risk Viewer, 'Global Climate-Related Risk Analytics', <https://global.infrastructureresilience.org/>.

CONTEXT AND CHALLENGE

Similar to other Caribbean islands, Jamaica is exposed to a range of climate-related hazards that can cause widespread damage to the population and infrastructure. Resources for infrastructure improvements are inevitably limited and need to be vigorously prioritized. Challenges identified by the government of Jamaica included:

- Exposure and vulnerability to multiple, severe and repeated climatic extremes
- Limited evidence to justify investing in infrastructure resilience
- The need to prioritize investments in the face of multiple economic challenges, including an existing burden of debt

TOOL APPLICATION

Since 2020, the University of Oxford has led the development of the Jamaica Systemic Risk Assessment Tool (J-SRAT) in partnership with the Planning Institute of Jamaica and the University of the West Indies in Mona. Customized for Jamaica from the SRAT base tool and methodology, the J-SRAT provides an interactive geospatial platform for climate risk assessments, integrating hazard mapping layers, detailed mapping of infrastructure exposure, economic analysis of climate impacts, and resilience prioritization.

OUTCOMES

The J-SRAT has significantly advanced the government of Jamaica's capabilities by:

- Providing innovative new analysis and evidence to enable the prioritization of scarce resources available to strengthen, enhance, replace and add to infrastructure networks in Jamaica.
- Bringing together relevant datasets, formatting them in an interoperable way, filling gaps and highlighting priorities for data collection.
- Providing insights into a range of adaptation options, including infrastructure strengthening, nature-based solutions and spatial planning.
- Assessing the scale of economic risks from infrastructure failure, which helps identify fiscal risks and contingent liabilities for the government of Jamaica.
- Providing evidence that will assist the government of Jamaica in accessing adaptation finance.
- Building capacity among staff in the government of Jamaica, the University of the West Indies and other stakeholders to use and update the analysis platform.

The J-SRAT has effectively responded to calls for the prioritization of systemic climate resilience in Jamaica. Having been developed in Jamaica, the potential for the J-SRAT to inform climate-resilient investments across the Caribbean and for the islands of the Indian Ocean is now being explored.

4. UNOPS and infrastructure resilience opportunities

This report recommends a suite of resilient infrastructure planning tools that can support governments and infrastructure planners in modelling and analyzing multi-hazard risks across infrastructure systems in order to assess infrastructure vulnerability and potential impacts and losses, as well as identifying and prioritizing interventions to improve infrastructure resilience. This host of capabilities can help address the pressing planning needs of countries while also ensuring alignment and speeding up and scaling up implementation towards the fulfilment of global agendas such as the 2030 Agenda, the Sendai Framework and the Paris Agreement.

UNOPS stands ready to support governments in their commitment to plan, deliver and manage resilient infrastructure by not only supporting the implementation of these tools but also providing project management support for the design, procurement, construction and asset management of infrastructure. UNOPS also provides technical advisory services in developing infrastructure financing strategies, supported through its FundABLE tool, as well as carrying out assessments of the enabling environment for infrastructure through its EnABLE tool.

Recognizing that the systemic nature of risk extends beyond planning to encompass both recovery and reconstruction efforts, UNOPS supports infrastructure resilience in complex situations, such as during humanitarian crises and in fragile and conflict-affected settings, through tailored and innovative technological solutions for real-time hazard monitoring, damage assessment and recovery planning.

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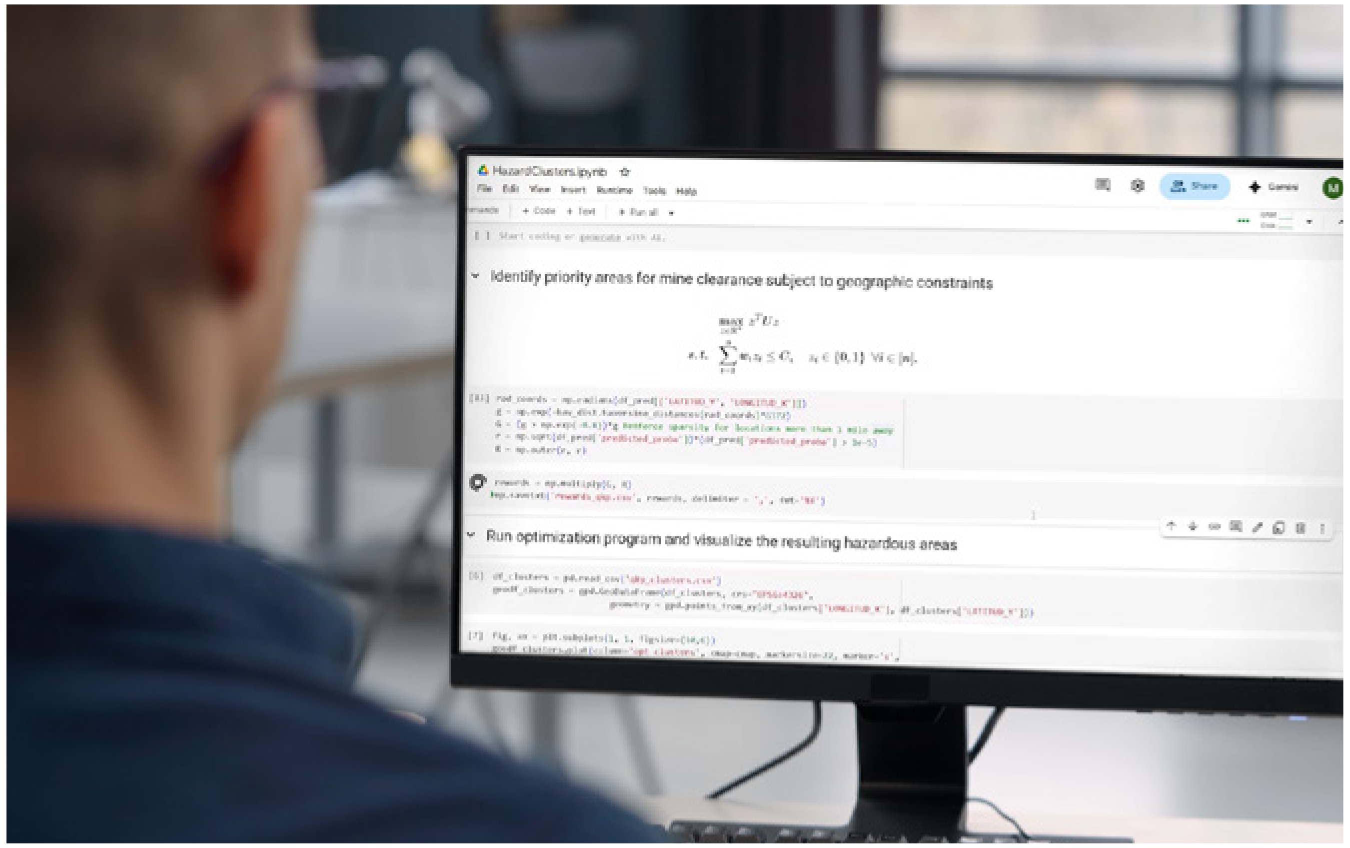
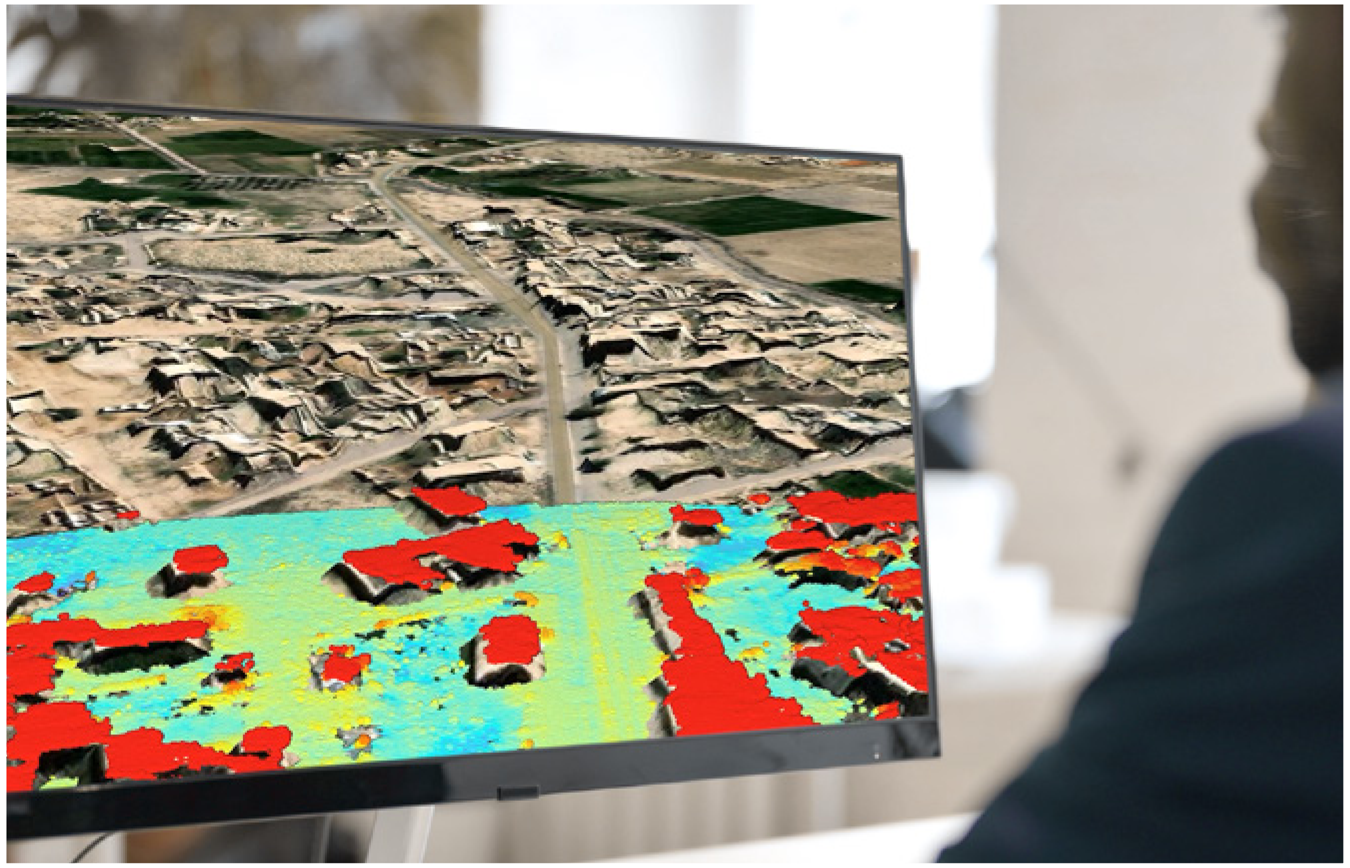
Resilient infrastructure planning in fragile and post-disaster contexts

In post-disaster contexts where infrastructure systems have been significantly damaged by conflicts or disaster events, there is a need to assess the damage incurred. In such cases, where landscapes may continue to change as rubble is moved and structures are demolished, real-time mapping and information can support better decision-making for immediate response and recovery, as well as informing long-term resilience planning and reconstruction. UNOPS provides advanced geospatial and artificial intelligence (AI) tools that can strengthen recovery and reconstruction efforts, particularly in fragile and disaster-affected places such as Ukraine, Gaza, South Sudan and Myanmar. With a range of capabilities, from real-time hazard monitoring to AI-driven recovery planning, UNOPS modular systems enhance the ability of governments and financing institutions to assess risk, prioritize investments and plan resilient infrastructure.

LEARN MORE

Watch a video about how UNOPS uses AI to transform mine action.





3D modelling and damage quantification: digital surface models and digital elevation models can support rapid damage assessment and recovery planning. Where commercial imagery is not available, the environment can be recreated using stereo imagery. © UNOPS

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